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GUIDELINES FOR THE DEVELOPMENT OF THE AGRICULTURAL MACHINERY AND IMPLEMENTS INDUSTRY IN LATIN AMERICA: COUNTRY CASE STUDIES

Volume II

Sectoral Studies Series
No.40

SECTORAL STUDIES BRANCH
STUDIES AND RESEARCH DIVISION

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Preface

For several years now UNIDO's Sectoral Studies programme has given specific attention to the agricultural machinery industry in various developing regions of the world, and in particular, Latin America. Based on earlier work undertaken within this programme, a study entitled "Guidelines for the development of the agricultural machinery and implements industry in Latin America", Volume I, Sectoral Studies Series No. 38, PPD.57, has been issued. It elaborates specific guidelines for national decision-makers, subregional and regional organizations for concrete programmes of action to stimulate the agricultural machinery industry in the developing countries of Latin America. Three country case studies on Brazil, Venezuela, and Guatemala are issued as Volume II of the study.

This study has been carried out in the Sectoral Studies Branch by Mr. George B. Assaf.

UNIDO would like to gratefully acknowledge the valuable information received from Latin American government officials and industry representatives in the preparation of this study.

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1. INTRODUCTION

This study presents case studies of the development of the Agricultural Machinery and Implements (AMI) industry in Brazil, Venezuela, and Guatemala. The study is the second of a two volume study which develops explicit strategies and guidelines at the national, subregional, regional and international levels for the development of the AMI industry in Latin America. On the basis of the country case studies presented in this volume and earlier work by the Sectoral Studies Branch of UNIDO on the AMI industry in Latin America, Volume I of this study presents practical guidelines for promoting the AMI industry in Latin America. It is believed that these guidelines can enable decision makers to implement an appropriate integrated development of AMI in the context of rural development which emphasizes maximum usage of forward and backward linkages in manufacturing industries, agriculture, infrastructure, and also the manufacturing processes within firms. The benefit of this integrated strategy, as developed in this study, is that there is a greater likelihood that programmes and projects that result from use of this strategy will be better suited to the countries of Latin America and hence more likely to meet with long term success.

The analysis in Volume II was developed from special country case studies made in connection with the Round-Table Ministerial Meeting of Co-operation among Developing Countries in the Field of the Agricultural Machinery Industry, Buenos Aires, Argentina, 3-7 November 1986.

This volume should be considered a complementary document to be consulted for specific illustrations of the general observations and guidelines developed in Volume I. It presents specific case studies of three Latin American countries - Brazil, Venezuela and Guatemala. These countries were chosen for the case studies since they represent the various levels of development in Latin American countries: an advanced large country (Brazil), an advanced medium-sized country (Venezuela), and a less advanced small country (Guatemala).

Volume II is divided into five chapters. Chapter 1 is the introduction to the study. Chapter 2 provides a summary of the findings and recommendations. Chapters 3 and 4 present consecutively the case studies of the development of the agricultural machinery industry in Brazil, Venezuela and Guatemala.

The study is directed towards the substantive UNIDO departments and divisions concerned with AMI and capital goods in general, other international agencies, regional and subregional organizations, and finally, decision-makers and researchers in both the private and public sectors in developing and industrialized countries, especially in Latin America.

The study can be used in several different ways. First, it can form a basis for the development of new methods for promoting AMI in developing countries and in Latin America in particular. Second, it can be used as a guide and support for UNIDO's operational projects and programmes relating to AMI and capital goods. Third, it can be used as a contribution to and support for the activities of other UN organizations, the UN regional commissions and subregional bodes. Fourth, it can be used as an instrument by local research and planning institutes in Latin America and elsewhere. Fifth, it can be used as a background document for private sector decision-makers interested in technology transfers, joint and other ventures in Latin America.

2. SUMMARY OF FINDINGS AND RECOMMENDATIONS

2.1 Brazil

2.1.1 Findings

In Latin America, Brazil is the leading producer of manufactured products in general and agricultural machinery and implements (AMI) in particular. It has a vast industrial potential. It has the most diversified and technologically advanced AMI industry in Latin America and one of the most advanced industries in the developing world. Most of the technology - approximately 80 per cent - now used in the industry is of domestic origin and design. Brazilian-made AMI products range from the most simple agricultural implements to advanced machinery and tractors.

The industry does not exist as a separate entity but is part of the metallurgical and transport equipment manufacturing industries. The present form of the industry began in 1960 with the establishment of the tractor industry in the country, and flourished with the production of harvesters in 1966. Former craftsman/workshops became repair-shops for imported machinery and developed into small firms which adapted imported AMI to local conditions.

The Government supported the development of the industry by an import substitution policy which levied extremely high tariffs on imports whenever similar goods were available domestically. Along with import controls the Government also provided tax exemptions and credit subsidies for those who wanted to invest in the industry or to buy AMI. There is evidence that these policies benefited the industry in the 1960s and early 1970s. The industry experienced particularly strong growth during 1970-1975. This was followed by a period of relatively stable growth during the ten years. The current situation of the industry is quite different. The industry has suffered a recent recession due to:

- Lack of a coherent agricultural and livestock production policy
- Lack of co-ordination of the policies directed towards the industry
- The uncertainty caused by frequent changes in agricultural and national economic policies;
- Inefficiencies in product engineering and rural credit schemes for the purchase of AMI;
- Regional imbalances in the growth of the industry;
- Foreign exchange constraints;
- Restrictive tariffs and other protective measures; and
- The fact that Brazil's National System of Metrology, Standardization and Industrial Quality (SINMETRO) is still in the early stages of development.

Currently, there are about 600 small and medium-sized firms which produce AMI in Brazil. These firms are located in the South-East and Southern regions of the country and are controlled, on the whole, by Brazilian stockholders. The major AMI produced are for soil preparation and planting. There are a number of large firms in the country which produce tractors and combined harvesters. These firms are either mostly or totally controlled by foreign parent companies or investment.

Brazil now possesses the experience and much of the technical know-how and institutional mechanisms to develop an extremely successful AMI industry. If the obstacles to production referred to above are addressed in an appropriate manner, the potential for growth in Brazil's AMI industry is enormous, especially at the international level.

2.1.2 Recommendations

(a) Government

The Brazilian Government, in consultation with private industry, farmers and other groups and institutions concerned with AMI may wish to:

- Strengthen their efforts to provide a stable economic and political environment conducive to the further development of the AMI industry;
- Intensify their efforts to develop Brazil's National System of Metrology, Standardization and Industrial Quality (SINMETRO);
- Address the weakness of the Brazilian AMI industry in product engineering;
- Restructure Brazil's system of tariffs, taxes, subsidies and other protective measures;
- Seek international technical assistance to:
  - (i) Establish counter-trades and innovative forms of ECDC/TCDC such as Multinational production Enterprises;
  - (ii) Initiate suitable projects to improve industrial productivity and quality;
  - (iii) Develop subcontracting arrangements for small-to-medium scale enterprises to correct regional imbalances in the production of AMI;
  - (iv) Develop expert system for the repair and maintenance of AMI;
  - (v) Match AMI producing sister enterprises in Brazil with those in other developing countries;
  - (vi) Restructure Brazil's rural credit schemes for the purchase of AMI.

(b) Regional bodies and international agencies

Regional bodies, UNIDO and other international agencies should consider the provision of appropriate technical assistance to:

- Restructure Brazil's rural credit schemes for the purchase of AMI;
- Assess the costs and benefits of counter-trades to the AMI industry - especially with African countries;
- Explore the possibilities of more extensive and innovative South-South co-operation in AMI such as counter-trades and Multinational Production Enterprises in a more routinized institutional framework;
- Strengthen Brazil's National System of Metrology, Standardization and Industrial Quality (SINMETRO) to improve the productivity of the AMI industry and the quality of its products; and, help to plan, design and implement pilot/demonstration programmes in this area;
- Encourage the growth of regionally dispersed small-to-medium scale production of AMI, associated infrastructure, industries and supporting institutions to redress the regional imbalances in the industry;
- Increase the transfer of technology to improve the design and manufacture of Brazil's AMI;
- Develop expert systems for the repair and maintenance of AMI for possible export to other developing countries;
- Pair sister AMI producing enterprises in Brazil with those in other developing countries - especially in Latin America - to act as a catalyst for the further development of Brazil's AMI industry.

2.2 Venezuela

2.2.1 Findings

In order to overcome its current economic problems the Government of Venezuela has given a very high priority to agriculture in its Seventh National Development Plan. The Government has also elaborated concrete programmes of action for agriculture in accordance with the high priority given to the sector. The Government argues that it is only by giving agriculture this prominent place that it can be made dynamic and capable of contributing significantly to the nation's food supplies, to the creation of employment, and to an improvement in the living conditions of the rural population.

In addition, the authorities hope that the high priority given to agriculture will help to modify substantially the existing structure of agriculture and lead to increased output and productivity of certain items of mass consumption for which production on a national scale is essential. It is hoped that the rational use of modern techniques and technologies can contribute to the achievement of these proposed objectives. The country is therefore turning towards the practical introduction of a modern form of agriculture in which a very important role will be played by the use of agricultural machinery and implements.

Venezuela's general strategy for the development of the capital goods industry, of which the agricultural machinery industry is a part, is to try to link better those industrial complexes which produce most of the equipment used in the various sectors of industry. To utilize Venezuela's comparative advantage, this calls for the establishment of multi-purpose production plants which are a complex of fully-integrated and complementary plants.

As the country is well provided with raw material and energy resources and its industrial plants function well, Venezuela has excellent possibilities of developing such multi-purpose enterprises for the production of goods and services.

The policy which is being pursued in Venezuela in the capital goods sector aims at establishing an integrated industrial complex of which the main feature is specialization of production and complementarity between enterprises. Plants with diversified production nevertheless form part of this complex.

In addition, the agricultural machinery and equipment manufacturing industry has sufficient installed capacity to satisfy domestic demand in those sectors where local production exists at present. It is necessary, however, to intensify efforts to achieve a greater degree of complementarity and co-operation between enterprises and with other sectors.

A study is also being made in Venezuela of the feasibility of commencing production of new agricultural equipment and implements suitable for the conditions of a tropical country as regards to soils, climate, crops and dietary habits. Such production could be undertaken on the basis of plants with diversified manufacturing processes, making use, as appropriate, of the experience of other developing countries.

However, there is a need for more intensive work in the field of standardization and rationalization of production. This will call for a reduction of the unnecessarily broad range of products in the subsector of agricultural machinery and equipment and in other capital goods subsectors. In this regard, it is clear that domestic demand scarcely justified the production of wheeled tractors. Also, effort should be made to standardize and reduce inventory costs.

2.2.2 Recommendations

Venezuela has need of technical assistance in a number of areas:

(a) The development and production of machinery and equipment for:

- Deforestation and utilization of land;
- The harvesting, conservation and conditioning, handling and transportation of agricultural products.

(b) The local production of tractors and spare parts which are currently imported, especially where there is a suitable local supply of raw materials that could be used to produce these goods.

(c) Research into and the production of machinery appropriate for local conditions.

(d) Training in the use and maintenance of AMI. This is the area in which Venezuela has the greatest need for technical assistance.

2.3 Guatemala

2.3.1 Findings

Agriculture, especially given Guatemala's low level of industrialization, is the major vehicle for the country's economic development. Priority has been given, and will continue to be given, to the export of agricultural products to help solve the country's balance of payments problems. Unfortunately, until recently, the promotion of large-scale agroexports has led to a reduction in Guatemala's ability to feed itself with its traditional food crops - beans, corn and rice. Indeed, in recent years, Guatemala has had to import these crops to be able to feed its people. Large-scale agroexports has led to the marginalization of the peasantry and a growing number of landless peasants. This has caused civil unrest and armed rebelliion in the late 1970s. The balance between the promotion of agroexports and the production of foodstuffs is a problem still unresolved in Guatemala as it is in most of Central America.

There are, however, good prospects for the development of the agricultural sector and therefore for the production of AMI and the growth of AMI industry. There are a number of reasons for this. At present, there is a food crisis in the country. There exists plenty of land that is under-utilized or not utilized at all. Agricultural machinery, tools and implements could increase productivity considerably. There is now official priority given to agricultural development. The Government is promoting the sector by various incentive schemes to aid domestic production and exports. The use of appropriate AMI in agriculture reduces production costs.

On the other hand, the potential for the development of a national AMI is limited by the following obstacles:

- Lack of adequate training in the use and maintenance of AMI;
- Lack of standardization of products;
- Lack of consistent planning of production;
- Lack of a coherent investment policy directed towards the industry;
- Indequate marketing of products;
- Indequate financing of production;
- Inadequate infrastructure, especially roads and communications;
- Extremely small markets for AMI.

2.3.2 Recommendations

The recommendations of this study for aiding the development of an indigenous AMI in Guatemala relate to external technical assistance, existing obstacles to the production of AMI, and areas for possible UNIDO technical assistance.

(a) Technical assistance

We begin with measures that the Government could implement to improve its ability to benefit from TA:

- Elaborate ITC (International Technical Co-operation) programmes that reflect the priorities set forth in National Development Plans that incorporate ITC as an explicit and quantifiable resource;
- Establish institutional mechanism to better co-ordinate ITC and TA;
- Re-inforce the national technical ability to identify, formulate and administer ITC and TA programmes;
- Allocate more financial and institutional support for technical co-operation projects;
- Appoint and/or train more personnel qualified to facilitate the transfer of technology.

External bodies such as international development agencies and individual developed countries could improve the quality of their ITC and technical assistance programmes as follows:

- Earmark the bulk of ITC for already identified problems;
- Make the terms of reference for experts clear and precise so as not to allow undesirable improvisation of activities and/or an inappropriate selection of candidates;
- Modify the structure of existing ITC arrangements to give more emphasis to training and supplying appropriate machinery and equipment.

(b) Obstacles to the production of AMI

The following steps could be taken to overcome existing obstacles to the production of AMI.

(i) Small market size could be tackled by:

- A carefully defined multi-production approach;
- Greater efforts to export to neighbouring countries organized into a common market as in the former CACM.

(ii) Inadequate marketing of products could be addressed by action at the national and/or regional levels to:

- Establish co-operative marketing schemes;
- Establish sales and exhibition centres;
- Create an advisory body to help market products;
- Establish centres where products can be displayed;
- Prepare a directory of manufacturers and sellers of AMI.

(iii) Inadequate financing of the production of AMI could be ameliorated by:

- Suitably designed credit schemes.

(iv) Insufficient technical knowledge is a major obstacle which requires a considerable amount of time to overcome.

In this regard, the following steps could be taken:

- A national and/or regional R&D centre could be established and/or existing centres strengthened;
- Simpler designs of AMI could be produced;
- TA should be sought from international agencies and/or more technologically advanced countries;
- Links should be established and/or existing links strengthened with neighbouring countries to share technical knowledge and the expenses incurred to acquire it and to train people to use and maintain AMI appropriately.

(c) Areas for possible UNIDO technical assistance in the field of AMI

Guatemala requires technical assistance in the following areas:

(i) The establishment of chemical and metallurgical laboratories to facilitate the production of AMI;

(ii) The formulation and implementation of projects for the production of handtools, especially big hoes;

(iii) Training in the design, testing, use and maintenance of appropriate AMI.

3. THE DEVELOPMENT OF THE AGRICULTURAL MACHINERY AND IMPLEMENTS INDUSTRY IN BRAZIL

3.1 The evolution of the agricultural machinery and implements industry

The agricultural machinery industry (AMI) in Brazil is very young. The industry does not exist as a separate entity but is part of the metallurgical and transport equipment manufacturing industries.[1/]

The foundations for the industry were laid in the 1950s at a time when industrialization was moving at a very fast pace in the country, especially in the durable goods sector. However, the industry actually started in 1960 with the establishment of the tractor industry and flourished with the production of harvesters (see table 1), which started in 1966. Under the stimulus of a national policy of import substitution, former draftsmanshops became repair-shops for imported machinery and after a time developed into small firms which adapted imported implements to local needs and characteristics. The spare parts industry in Brazil is a good example of this process. The various repair shops of this industry initially served the needs of the automobile industry maintaining and servicing imported machinery. In the course of time these shops reproduced the machinery and implements that were previously imported and added improvements and/or changes to adapt them to the needs of local farmers.

The growth of the AMI was greatly encouraged by Brazil's agricultural potential which attracted Brazilian as well as transnational corporations.

It is probable that the greatest attraction of the agricultural industry was, and still is, the size of the domestic market. The Government supported the domestic market by an import substitution policy which levied extremely high tariffs on imports whenever similar goods were available domestically. Along with import restrictions, the Government also aided those who decided to invest in the industrial sector. Upon approval of the project by the CDI (Industrial Development Council), a firm could obtain fiscal incentives such as exemption from, or reduction of, the customs duties on imports of machine tools or of parts and components for the production of AMI. Businesses with a majority of capital in the hands of Brazilian nationals could obtain medium and long term financing, provided mainly by the BNDES (National Bank for Economic and Social Development) at negative real interest rates, in effect a subsidy. Subsidized credit was also given for the purchase of agricultural machinery and for the promotion of AMI exports.

1/ This study draws on the Brazilian national paper on agricultural machinery, "Brazilian Agricultural Machinery Industry - Current Technical Supporting Programmes", prepared by Messrs. Cid Vinio Silveira Santos and Luiz Geraldo Mialhe; respectively, Co-ordinator, Sub-programme Agricultural Engineering, Institute of Technological Research (IPT), Sao Paulo and, Assistant Professor, Department of Rural Engineering (ESALQ), University of Sao Paulo. The Brazilian national paper was presented at the UNIDO-INTI Ministerial Roundtable on Agricultural Machinery held at Buenos Aires, Argentina, 2-7 November 1986. This paper was prepared in accordance with guidelines elaborated by UNIDO's Sectoral Studies Branch.

Despite some controls and limitations imposed on the remittance of profits by their Brazilian branches, there were no major obstacles to foreign companies coming into the country. A transnational corporation could operate in the country with 100 per cent of its capital in foreign hands. The idea behind the policy towards foreign corporations was to maximize the domestic production of goods, and/or the production of goods with the greatest possible index of domestic content. This policy gave preference to goods that were either basic to the domestic market or that had a good export potential. Due to vigorous competition between the large number of transnational corporations operating in the agricultural machinery sector, especially in the production of more sophisticated goods, advanced technologies were introduced without any special encouragement by the Government.

In the 1970's the Government gave strong support to the development of the capital goods sector . From the point of view of the BNDES, the agricultural machinery industry was part of the capital goods sector and thus fell within the Bank's financing priorities. The Government's support of the AMI industry: generous incentives were given to locally produced goods - "Lei do Similar National" and tax and foreign exchange exemptions - led to rapid growth in the industry during 1970-1975 followed by relatively stable growth until 1980 (table 2).

Table 2 shows the major changes in industry indicators after 1980. During 1980-1983, the value of production declined by a third, but recovered after 1983.

In 1984 tractor sales rose sharply by almost 95 per cent to more than 50,000 units, 90 per cent of which was destined for the domestic market. In addition, tractor exports in 1984 increased by about two thirds. This was partly due to the higher income levels of farmers as a result of more profitable "minimum prices" for agricultural products, and partly because of the need to replace obsolete equipment.

The current situation of the AMI is somewhat uncertain. The industry was given a fillip by the introduction of the economic recovery plan (Plan Cruzado). This enabled firms to increase production and sales levels. Unfortunately the recent difficulties experienced by this recovery programme has caused sales and production levels to slump again.

Table 1. Brazil: Production, imports and exports of tractors and harvesters, 1965-1984

Year	Tractors[a/]			Harvesters		
	Production	Imports	Exports	Production	Imports	Exports
1965	8,121	374	-	-	61	-
1966	9,060	639	6	12	80	-
1967	6,223	342	31	28	392	-
1968	9,671	990	7	84	780	-
1969	9,547	423	7	282	1,039	-
1970	14,048	60	41	750	1,646	-
1971	22,122	184	104	1,150	2,087	-
1972	30,207	228	188	1,921	1,014	4
1973	39,232	258	386	3,506	1,096	25
1974	46,848	347	895	4,993	2,601	96
1975	59,166	801	649	7,323	2,570	223
1976	65,327	191	472	7,289	521	129
1977	52,966	39	4,584	5,054	148	240
1978	48,675	-	6,134	4,298	6	132
1979	55,247	-	7,263	4,663	-	246
1980	58,812	-	7,743	6,601	-	311
1981	39,341	-	10,073	5,049	-	345
1982	30,346	-	6,239	5,545	-	127
1983	22,612			3,573		
1984	45,907			6,199		

a/ Four-wheeled tractors.

Source: Associaçao Nacional de Fabricantes de Veiculos Automotrizes ANFAVEA and Associaçao Brasileira da Indústria de Máquinas e Equipamentos ABIMAQ.

Table 2. Brazil: Profile of the agricultural machinery and implements industry (other than tractors) - 1970, 1975 and 1980

Year	Number of establishments	Number of employees	Production value $US million
1970	365	14,300	95.7
1975	552	28,500	696.3
1980	580	27,500	898.5

Source: Censos Industrias - IBGE.

Table 3. Brazil: Profile of the agricultural machinery and implements industry (other than tractors), changes (per cent) - 1980-1984

	1980	1981	1982	1983	1984
Employment	9.0	2.5	-10.6	-17.9	16.5
Production value	14.9	-2.7	-14.6	-12.9	27.3

Source: ABIMAR.

3.2 Structure of the Brazilian agricultural machinery and implements (AMI) industry

3.2.1 Land tenure and ownership patterns of farms in Brazil

In spite of the continuous increase in the amount of land brought into cultivation, only a small percentage of total available land has been put to arable use. For example, in 1979, only 7.3 per cent of total available land was used for arable purposes, compared with 6.4 per cent during the previous 10 years. Of the total available land area, 68 per cent was forest and woodland; of the arable area, in 1979, only 3 per cent was irrigated (1.7 million hectares out of 61.5 million hectares). As in many other countries of Latin America, land ownership and land tenure patterns in Brazil show a markedly skewed distribution.[2/] Some indication of the skewed distribution of land ownership can be seen from the data presented in the following table.

Table 4. Size distribution of farms in Brazil in 1979

Hectares	Percentage	No. of production units
Less than 10	15.8	2,600,000
10-50	30.0	1,900,000
50-1,000	11.2	450,000
1,000-10,000	31.6	40,000
More than 10,000	11.4	1,800

Note: In 1979 the total number of hectares devoted to agriculture were distributed as follows:
- 8,294,000 hectares of permanent crops
- 20,508,000 hectares of temporary crops.

Source: Report on Brazil by Reginald Ledgard, Consultation on the Agricultural Machinery Industries, March 1979, p. 4.

Additional information about land ownership is provided by a survey in 1967 by the Brazilian Institute of Agrarian Reform (IBRA) which found that 76 per cent of the total number of registered properties were owned by smallholders who generally had too little land to provide adequate work or subsistence for a family. The total area of land owned by smallholders was 2.5 million hectares, which was less than 14 per cent of the total area of land held in private ownership. By contrast, only 150 large landowners owned land amounting approximately to 32 million hectares. During the 1970s and early 1980s there has been some change in land ownership patterns but the direction of these changes has been towards increased concentration of land in the hands of the large landowners. This situation could have serious consequences in rural areas where as many as two thirds of the population

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2/ The Economist Intelligence Unit, Quarterly Economic Review of Brazil, Annual Supplement 1983, p. 12.

which depends on agriculture for their livelihood are landless agricultural workers. To get some idea of the gravity of this rural problem in Brazil, in 1980 the total agricultural labour force was 15 million workers, therefore as many as 10 million workers plus their families may be affected.

The present Brazilian Government is taking some steps to restructure the distribution of land ownership. It has reactivated an agrarian reform law passed in 1965, which allows the Government to make compulsory purchases of land that it classes as unused. In 1985 the "Plano Nacional de Reforma Agraria" was introduced, which aims to settle 1.4 million families (approximately 7 million people) on land which the Government regards as unused as well as on public land (terras devolutas) during the period 1985-1989. The plan is to expropriate nearly 107 million acres, an area the size of Spain, and settle the 1.4 million families there.

The plan does not aim at radical reforms but simply to alleviate tensions between private owners and landless peasants and extend the total amount of land under cultivation. Under the plan, there is no intention of developing new infrastructure and technology. At present, the plan is meeting strong resistance from those who hold land as a hedge against inflation as well as from the large landowners and landlords.

About 45 per cent of the land being expropriated is in the North-east of the country.[1/] It is claimed that some 600,000 families will benefit from this move and an additional 107,000 families should benefit from the redistribution of 17,000 square kilometres of land in the state of Sao Paulo.[2/]

Another objective of the plan is to try to reduce the number of uneconomic smallholdings of 25-30 hectares or below. The Government aims to do this by making credits available to allow farmers to buy each other out, and by encouraging the pooling of resources - for example, tractors and fertilizers - between them.[3/]

These land reforms do not seem to have slowed agricultural production. Brazil is set to have a record harvest this year. The corn, rice and soya crops are expected to be over 62 million tonnes in total compared with an annual average of 50 million tonnes during the previous decade. The output of corn is expected to rise by 21 per cent since 1986, to 28 million tonnes, beans by 21 per cent to 2.7 million tonnes, soya by 19 per cent to 16 million tonnes, sugar by 5 per cent to 272 million tonnes, and rice by 4 per cent to 11 million tonnes. Only the output of manioc is expected to have less spectacular growth rates: manioc, up 1 per cent to 27 million tonnes, and cotton, a decrease of 13 per cent to 2 million tonnes.[4/]

3/ The Economist, Survey: Brazil, April 25, 1987, pp. 1-26 and especially p. 18.

4/ Ibid., p. 18.

5/ Ibid., p. 18.

6/ Ibid., p. 18.

3.2.2 Domestic production of AMI[7/]

(a) Industrial profile

It is difficult to assess the extent of the AMI industry since as previously mentioned its activities are partly merged with those of the metallurgic, metalworking and automotive industries. However, it is possible to estimate, based on data provided by the Industrial Census of 1980, that in 1980 the total number of plants engaged in this activity, with the exception of hand tools, was approximately 600. In addition, the industry employed over 30 thousand people and the gross value of its output was almost $US 1.7 billion with the tractor industry accounting for 46 per cent of this gross value of production.

A more reliable estimate about the number of establishment is provided by the 340 member firms of the ABIMAQ - "Associacao Brasileira de Industria de Máquinas e Implementos Agricolas"- belonging to the AMI sub-sector. According to ABIMAQ, its members account for 92 per cent of the total production of Brazilian AMI.

The implements segment of the industry comprises mostly small or medium-sized firms financed predominantly by Brazilian capital,[8/] whereas the machine industry consists of large or medium-sized firms with significant foreign capital investment.

There is no specific information available as regards the production of agricultural handtools since the majority of factories produce both agricultural and non-agricultural tools. However, the Industrial Census of 1980 showed 514 firms engaged in the production of handtools. These firms employed over 15,000 people, and had a gross value of production amounting to $US 263 million. One way to evaluate the relative importance of the agricultural machinery and implements industry (with the exception of tractors) is to compare it to the metalworking sector as a whole. The AMI industry's share of the total number of plants in the metalworking sector was 5.9 per cent; its share of the total labour force was 5.1 per cent, and that of the total value of production was 6.5 per cent.

As shown in table 5 average productivity in 1980 reached almost $US 33,000 per employee in the agricultural machinery and implements industry as a whole, $US 74,000 for the tractor sub-sector alone.

The share of value added in the overall value of production was 45 per cent for the AMI industry as a whole as opposed to 34 per cent for the tractor sub-sector.

7/ This section is based on UNIDO/IS.607, "The Multipurpose Approach to Agricultural Machinery Manufacturing in Latin America", Sectoral Working Paper Series No. 46, 12 February 1986.

8/ The classification of small and medium-sized industries in Brazil includes, among other factors, a greater number of employees than used in UNIDO reports.

Table 5. Brazil: The agricultural machinery and implements industry - 1980

Activities	Enterprises		Employees		Salaries	Value of production		Value added	(4)/(2)	(3)/(2)	(5)/(4)
	Unit	per cent	number	per cent	$1,000	$1,000	per cent	$1,000	ratio	ratio	ratio
Agricultural Machinery and Implements	216	37.2	11,710	42.6	36,528	443,074	49.3	167,400	37.8	3.1	0.38
Sprayers	25	4.3	1,929	7.0	8,178	73,207	8.2	42,979	38.0	4.2	0.59
Agricultural, Horticultural, Poultry-keeping and Bee-keeping Machinery	56	9.7	2,274	8.3	5,977	64,782	7.2	30,664	28.5	2.6	0.47
Machinery N.E.C.	114	19.7	3,910	14.2	12,125	123,397	13.7	59,450	31.6	3.1	0.48
Processing Machinery	77	13.3	2,985	10.9	8,065	72,106	8.0	42,163	24.2	2.7	0.58
Parts and Accessories	92	15.8	4,655	17.0	14,497	121,898	13.6	61,841	28.2	3.1	0.51
Sub-total	580	100.0	27,463	100.0	85,370	898,464	100.0	404,497	32.7	3.1	0.45
Tractors	17		3,560		17,533	773,852		262,220	73.7	4.9	0.34
TOTAL	597		31,023		102,903	1,672,316		666,717			

Source: Censo Industrial 1980. IBGE.

Most of the technology used in the industry is of domestic design and origin; the share of imported components in the total value of production is only about 3.8 per cent for tractors, and 2 per cent for harvesters. The Government controls the domestic content of AMI through the Conselho de Desenvolvimento Industrial (CDI). However, foreign capital plays an important role either by means of partnerships with Brazilian firms or complete control in the form of a transnational subsidiary.

(b) Composition of production

The Brazilian agricultural machinery and equipment industry is highly diversified, both in terms of providing for farming needs and the amount of manufactured products. As shown in table 6 the industry caters to all aspects of farming activity. Almost 60 per cent of total sales, however, consists of products for harvesting and soil preparation.

The great diversification of the industry, especially in items for soil preparation, is shown in table 7. The table shows that:

- A set of 34 products accounted for about 80 per cent of the value of sales in the past nine years;

- With the exception of self-propelled combine harvesters, all other products under consideration have only a minor share of total industry sales.

(c) Agricultural mechanization

Despite the large amount of machinery and equipment produced in Brazil, the degree of agricultural mechanization is still relatively small. The overall number of tractors more than trebled between 1970 and 1980. In 1980 Brazil had 545,000 tractors which represented 8.7 tractors per one thousand hectares, or 115.6 hectares per tractor. During 1980-1983 there was a significant decrease in the level of mechanization, due to a reduction in sales and the great need for replacements.

Table 8 presents some statistics on the main types of agricultural machinery and implements. It is interesting to see that the mechanical traction plough is being used at the same rate as tractors and, at the same time, as a substitute for animal-pulled ploughs. The table also shows that over time there has been a clear preference for highly powered tractors.

(d) Foreign trade

The total value of imports and exports of agricultural machinery and implements are insignificant compared to the total value of domestic production. In fact, based on the value of sales made by ABIMAQ (see table 6) in the period 1975-1983, the foreign market absorbed less than 7 per cent of the total sales.

Another way of showing this is to compare the industry's total value of production for the year 1980 with total exports and imports. In 1980, the industry's total value of production was $US 1.7 billion whereas exports were $US 145 million and imports only $US 15 million.

Table 6. Brazil: Value of sales of agricultural machinery and implements - 1975-1983
($US thousand 1980)

Agricultural operations	1975		1976		1977		1978		1979		1980		1981		1982		1983	
	value	per cent	value	per cent	value	per cent	value	per cent	value	per cent	value	per cent	value	per cent	value	per cent	value	per cent
Soil preparation	203.7	29.6	287.5	36.4	255.9	34.8	214.8	31.8	193.4	30.1	168.0	27.8	118.6	19.8	107.5	22.4	101.3	26.6
Sowing	50.0	7.2	42.3	5.4	31.8	4.3	28.8	4.3	29.6	4.6	40.6	6.7	24.7	4.1	19.8	4.1	25.3	6.6
Cultivation	4.5	1.0	12.3	1.6	11.4	1.6	10.6	1.5	11.0	1.7	17.0	2.8	18.1	3.0	11.9	2.5	10.7	2.8
Irrigation and Drainage	39.2	5.6	30.4	3.9	28.0	3.8	55.8	8.3	42.3	6.6	30.6	5.1	52.4	8.8	53.8	11.2	18.6	4.9
Pesticides application	36.2	5.3	51.4	6.5	67.3	9.2	59.5	8.8	57.6	9.0	42.4	7.0	45.4	7.6	42.8	8.9	30.9	8.1
Harvesting	269.3	39.0	273.2	34.5	234.4	31.9	177.7	26.3	212.5	33.2	205.3	34.0	222.0	37.3	138.5	28.8	118.3	31.1
Transportation and handling	21.2	3.6	25.6	3.2	46.2	6.3	38.5	6.0	31.0	4.8	31.3	5.2	29.1	4.9	30.5	6.4	26.2	6.9
Processing and storing	63.3	9.2	67.2	8.5	59.6	8.1	88.4	13.0	64.4	100.0	68.6	11.4	85.9	14.5	75.1	15.7	49.6	13.0
TOTAL SALES	687.4	100.0	789.9	100.0	734.6	100.0	674.1	100.0	641.8	100.0	603.8	100.0	596.2	100.0	479.9	100.0	380.9	100.0
INTERNAL MARKET	673.9	98.0	779.2	98.6	714.2	97.4	640.9	95.1	616.3	96.0	566.1	93.7	559.4	93.8	454.3	94.7	360.6	94.7

Source: Associacão Brasileira da Indústria de Máquinas e Equipamentos - ABIMAQ.

Table 7. Brazil: Value of sales of the main products among the agricultural machinery and implements, 1975-1983

Equipment	1975		1976		1977		1978		1979		1980		1981		1982		1983	
	Value	Per cent	Value	Per cent	Value	Per cent	Value	Per cent	Value	Per cent	Value	Per cent	Value	Per cent	Value	Per cent	Value	Per cent
PREPARATION OF SOIL																		
Plough (tractor-driven)	33.9	5.0	57.3	7.4	70.9	9.9	35.3	5.2	21.8	3.4	24.7	4.1	13.0	2.2	8.2	1.7	9.9	2.6
Plough Discs	-	-	0.1	0.0	0.1	0.0	5.5	0.8	3.9	0.6	2.5	0.4	2.2	0.4	5.0	1.0	3.2	0.8
Harrow Discs	-	-	-	-	-	-	17.4	2.6	14.8	2.3	16.8	2.8	21.8	3.6	24.9	5.2	15.6	4.1
Rotary Cultivator	5.7	0.8	9.2	1.2	9.0	1.2	4.6	0.7	5.2	0.8	5.2	0.9	3.2	0.5	5.0	1.0	2.7	0.7
Harrow (tractor drawn)	6.3	0.9	1.8	0.2	21.5	3.0	38.3	5.7	34.8	5.4	44.9	7.4	2.4	0.4	8.9	1.9	8.5	2.2
Plowing Harrow	12.9	1.9	52.2	6.7	23.4	3.3	9.6	1.4	7.6	1.2	7.3	1.2	10.9	1.8	11.0	2.3	6.3	1.7
Levelling Harrow	11.9	1.8	20.9	2.7	12.0	1.7	11.3	1.7	19.0	3.0	10.0	1.7	16.6	2.8	3.8	0.8	10.7	2.8
Front notched Blades	0.6	0.1	1.2	0.2	0.8	0.1	13.3	2.0	15.1	2.4	7.7	1.3	0.2	0.0	0.2	0.0	0.0	0.0
Post Hole Diggers	-	-	-	-	-	-	1.6	0.2	1.3	0.2	0.8	0.1	1.0	0.2	7.9	1.7	0.8	0.2
Rear Grader Blades	19.7	2.9	30.9	3.9	25.1	3.5	19.3	2.9	11.6	1.8	12.4	2.0	3.6	0.6	1.9	0.4	2.1	0.5
Rotavator	5.3	0.8	8.5	1.1	6.2	0.9	3.8	0.6	5.3	0.8	5.7	1.0	3.2	0.5	0.1	0.0	1.0	0.3
Rotary Cutters	16.3	2.4	15.3	2.0	15.4	2.1	11.3	1.7	16.0	2.5	13.8	2.3	17.7	3.0	11.3	2.3	10.6	2.8
Super Heavy Harrow	-	-	-	-	-	-	1.8	0.3	2.3	0.4	1.6	0.3	3.3	0.6	7.1	1.5	4.7	1.2
SEEDING, PLANTING AND FERTILIZING																		
Fertilizing Planter	14.6	2.2	18.2	2.3	17.5	2.4	12.6	1.9	10.0	1.7	22.3	3.7	10.9	1.8	7.1	1.5	13.3	3.5
Combine Drills	30.9	4.6	17.9	2.3	9.1	1.3	9.6	1.4	9.7	1.5	8.2	1.4	6.0	1.0	4.3	0.9	1.8	0.5
CULTIVATION																		
Cultivator (tractor driven)	2.8	0.4	11.3	1.4	10.0	1.4	8.6	1.3	8.8	1.4	13.2	2.2	14.9	2.5	8.5	1.8	6.6	1.7
Irrigation Equipment	-	-	-	-	-	-	20.3	3.0	9.8	1.5	8.7	1.4	22.1	3.7	23.6	4.9	9.3	2.4
Pumps	13.3	2.0	15.6	2.0	15.3	2.1	23.1	3.4	13.8	2.1	12.8	2.1	11.6	1.9	15.8	3.3	3.8	1.0
Pipe (witted with quick couplers)	-	-	-	-	-	-	10.3	1.5	10.0	1.6	6.4	1.1	14.7	2.5	11.4	2.4	4.1	1.1
PESTICIDES APPLICATORS																		
Sprayer	5.3	0.8	5.6	0.7	7.5	1.0	4.6	0.7	4.4	0.7	5.1	0.8	6.1	1.0	4.8	1.0	3.6	0.9
Boom Sprayers	12.5	1.9	19.3	2.5	23.3	3.2	15.0	2.2	11.5	1.8	10.0	1.7	10.2	1.7	16.8	3.5	12.6	3.3
Knapsack or manual Sprayers	11.4	1.7	13.8	1.8	25.3	3.5	24.0	3.6	12.9	2.0	7.0	1.2	10.6	1.8	6.8	1.4	3.9	1.0
Speed Sprayers	-	-	-	-	-	-	4.5	0.7	5.6	0.9	4.6	0.8	4.8	0.8	5.5	1.1	2.8	0.7
HARVESTING																		
Self-Propelled Harvesters	262.7	38.9	264.5	33.8	187.9	26.1	156.1	23.2	197.7	30.7	187.7	31.0	195.9	32.8	122.5	25.7	111.8	29.4
TRANSPORT AND HANDLING																		
Sugar Cane Loaders	1.3	0.2	6.9	0.9	9.0	1.2	7.5	1.1	5.5	0.9	3.9	0.6	9.2	1.5	6.5	1.3	4.3	1.1
Dumping or fixed farm wagon	15.2	2.2	11.4	1.5	17.9	2.5	9.9	1.5	9.1	1.4	8.5	1.4	6.3	1.0	6.7	1.4	4.6	1.2
Elevator	-	-	1.5	0.2	15.8	2.2	10.6	1.6	8.2	1.3	2.6	0.4	3.8	0.6	9.8	2.0	3.8	1.0
PROCESSING AND STORING																		
Rice Hulling & Grazing Machine	6.4	1.0	5.9	0.8	11.7	1.6	5.7	0.8	5.8	0.9	8.5	1.4	5.6	0.9	5.5	1.1	3.9	1.0
Grain Graders	0.8	0.1	2.9	0.4	8.4	1.2	9.4	1.4	6.1	1.0	7.4	1.2	10.9	1.8	5.2	1.1	5.6	1.5
Desintegrator	12.5	1.9	15.7	2.0	8.5	1.2	6.7	1.0	5.4	0.8	10.6	1.8	9.0	1.5	7.3	1.5	3.8	1.0
Forage Chopper and Grinder	4.9	0.7	2.8	0.4	6.3	0.9	5.0	0.7	3.2	0.5	3.1	0.5	2.9	0.5	5.8	1.2	3.8	1.0
Fixed Dryers	21.8	3.2	22.3	2.9	17.6	2.4	25.3	3.8	14.6	2.3	5.3	0.9	16.0	2.7	10.6	2.2	7.7	2.0
Separator	-	-	-	-	-	-	-	-	0.2	0.0	1.1	0.2	2.0	0.3	4.6	1.0	2.7	0.7
Silo	-	-	-	-	0.1	0.0	2.3	0.3	1.4	0.2	16.9	2.7	18.8	3.2	19.4	4.0	8.5	2.2
OTHERS	158.6	23.1	156.8	19.9	159.1	21.7	129.7	19.1	128.4	20.0	96.6	16.0	104.9	17.5	76.0	15.9	82.1	21.8
TOTAL	687.6	100.0	790.0	100,0	734.6	100.0	673.9	100.0	641.8	100.0	603.9	100.0	596.3	100.0	479.8	100.0	380.5	100.0

Source: Associação Brasileira da Indústria de Máquinas e Equipamentos - ABIMAQ.

Table 8. Brazil: Agricultural machinery and implements in operation

Items	1950 Units	1960 Units	1970 Units	1970 Per cent	1975 Units	1975 Per cent	1980 Units	1980 Per cent
Tractors	8,372	61,324	165,870	100.0	323,113	100.0	545,289	100.0
less than 10 HP			19,620	11.8	26,773	8.3	27,567	5.1
10 to 50 HP			80,952	4.8	86,870	26.9	128,944	23.7
50 to 100 HP			61,554	37.1	188,892	58.4	329,023	60.3
more than 100 HP			3,744	2.3	20,778	6.4	59,671	10.9
Harvesters			84,707		98,184		119,076	
Ploughs			1,878,925	100.0	2,093,960	100.0	2,236,577	100.0
Animal-drawn			1,718,041	91.4	1,758,051	84.0	1,677,408	75.0
Tractor-driven			160,884	8.6	335,909	16.0	559,169	25.0

Source: IBGE, Censos Agropecuários do Brasil.

An analysis of exports and imports during the period 1975-1984, shows that the balance of trade was very favourable for Brazil and the ratio of the value of exports to imports rose from 0.33 in 1975 to 9.9 in 1980 and 57.2 in 1984.

(i) Imports

The value of foreign purchases shows a more or less steady decline for the period 1975-1984, decreasing from $US 76 million to less than $US 2 million, which indicates that the domestic industry is practically self-sufficient. This decline in the value of foreign purchases was particularly significant in 1976 when imports fell by two-thirds (see table 9).

As to the composition of imports, harvesting and threshing machinery are the most important group throughout the period. However, these machines accounted for the drastic reduction of total imports in 1976, when the self propelled combine harvester-thresher was replaced by products made in Brazil. Other important categories are dairy machines, machines for wine-making and similar activities and machinery used in the grain milling industry. These are all connected to the food and beverages industries which are undergoing a process of modernization and expansion. However this process of modernization and expansion is not uniform or successful in all subsectors of the food and beverages industries. For example, the vegetable oil products subsector is experiencing little modernization or expansion.

It is important to note that more than a third of the total value of imports in later years was for spare parts and components, probably for machinery and implements bought before the import substitution era.

(ii) Exports

The total value of exports (see table 10) increased steadily from 1975 ($US 25 million) to 1981 when they reached a peak of $US 163 million. During the two subsequent years there was a sharp decrease. In 1984 exports recuperated when they reached a value of nearly $US 100 million.

The increase of exports was mostly due to the increase in the sales of tractors. In the period 1977-1982, tractor exports accounted for over 60 per cent of the total exports. This percentage was significantly greater than any other AMI product exports.

Another important category is that of harvesting and threshing machinery, especially self-propelled combine harvester-threshers. As it can be seen from the table, these machines played an important role in Brazil's balance of trade. More recent data would probably show a similar trend.

Other categories that stand out in the export profile are: cleaning, winnowing and sorting machines for grains, seeds, etc., disc harrows, and some hand tools.

Table 9. Brazil: Imports of agricultural machines and implements - 1975-1984

(US$ thousand CIF)

BTN	PRODUCT GROUP AND MAIN ITEMS	1975		1976		1977		1978		1979		1980		1981		1982		1983		1984	
82.01	HAND TOOLS FOR AGRICULTURE	766,9	1.0	240,2	0.9	339,7	2.0	517,1	4.1	470,9	4.1	444,5	3.0	343,4	4.3	338,5	4.0	163,8	3.2	100,2	6.0
	- Curved machetes	238,2		73,0		132,8		234,3		238,9		210,6		133,6		307,5		122,8		80,1	
	- Spades, hoes, picks, shovels and mattocks	94,5		3,1		3,3		6,6		3,5		5,3		1,0		0,9		0,2		1,0	
	- Hedge shears	37,4		24,4		45,8		65,1		37,8		34,2		8,1		2,7		3,6		1,7	
	- Bill hooks and machetes	252,8		82,4		100,5		124,7		66,4		78,3		177,2		3,1		0,1		-	
84.21	SPRAYERS, DUSTERS AND SIMILAR	820,3	1.1	307,7	1.2	1,037,3	6.1	735,6	5.8	620,0	5.3	2,299,7	15.7	540,0	6.8	300,1	3.9	121,7	2.4	17,1	1.0
	- Power sprayers	730,1		139,7		122,7		104,8		284,8		2,160,4		379,9		176,2		18,7		-	
84.24	MACHINERY FOR SOIL PREPARATION AND CULTIVATION	1,949,9	2.6	1,178,9	4.6	1,044,0	6.2	926,0	7.3	1,008,1	8.7	885,6	6.0	722,3	9.1	768,8	9.0	506,0	10.0	70,6	4.2
	- Cultivators	101,3		8,5		69,1		80,0		7,1		12,0		-		139,3		293,5		15,6	
	- Disc harrows	135,0		0,9		202,2		16,2		12,2		0,8		3,2		23,2		-		-	
	- Fertilisers distributors	130,4		215,9		11,9		25,8		33,4		16,5		1,6		28,4		-		2,8	
	- Seeders, combined seed and fertiliser distributors, planters, transplanters	326,5		394,3		63,1		68,8		49,0		122,1		17,1		73,8		153,7		3,6	
	- Composed units (tractor and implement) for soil preparation and cultivation	353,9		6,5		107,0		200,4		424,2		198,0		468,6		98,6		-		1,8	
	- Parts	497,0		317,0		357,9		470,4		440,6		445,0		78,3		326,5		48,8		36,3	
84.25	HARVESTING AND THRESHING MACHINERY AND SIMILAR	56,328,2	72.7	15,850,1	61.5	5,289,5	31.2	5,418,7	42.9	3,748,2	32.3	3,757,5	25.6	3,209,6	40.4	2,551,2	41.6	2,187,5	43.2	463,0	27.7
	- Combine harvester-thresher	45,262,9		9,258,1		1,063,9		3,379,0		813,1		76,6		170,7		189,8		364,8		108,0	
	. self-propelled	43,861,1		8,618,6		945,7		3,285,2		653,5		46,5		84,9		-		364,8		9,4	
	- Baling-presses	-		62,1		17,8		193,2		3,3		33,1		-		218,4		-		-	
	- Lawn mowers	842,2		226,3		85,5		219,5		147,2		58,8		52,0		80,0		10,0		10,1	
	. other than motor driven	563,3		64,5		7,0		9,5		13,5		9,8		0,4		5,5		1,8		1,2	
	. motor driven	278,9		161,8		78,5		210,0		133,7		49,0		51,6		34,5		8,2		8,9	
	- Caifablits lawn mowers	1,774,8		575,0		345,7		421,5		407,3		839,7		378,5		369,0		170,8		0,2	
	- Cleaning, winnowing and sorting machines for grains, seed and similar	226,7		253,6		199,9		89,1		640,1		151,2		118,4		453,4		630,5		74,6	
	- Machines for grading eggs, fruits, potatoes, onions and other products	251,2		27,7		14,9		-		164,2		-		-		-		726,6		-	
	- Parts	5,073,1		3,061,8		2,236,2		937,0		1,075,8		3,098,9		2,003,2		1,183,5		559,0		278,1	
84.26	DAIRY MACHINES	1,268,6	1.7	1,125,5	4.4	1,481,6	8.7	1,330,9	10.5	2,068,1	17.8	1,140,7	7.8	640,8	8.1	457,3	5.4	598,8	11.8	298,7	17.9
	- Milking machines	333,3		229,2		99,1		150,1		133,1		104,4		26,2		21,6		33,5		-	
	- Milk homogenisers	136,8		83,7		184,8		144,4		269,4		182,9		163,2		192,4		113,4		47,1	
	- Cheese-making machines	225,3		41,4		7,6		505,0		56,7		303,2		36,6		-		-		6,5	
	- Parts	317,4		535,6		506,1		388,3		691,5		517,6		316,0		130,3		234,8		232,0	
84.27	PRESSES, CRUSHERS, AND OTHER MACHINES FOR WINE MAKING AND SIMILAR	553,1	0.7	259,3	1.0	609,3	3.6	111,6	0.9	1,942,1	16.7	673,7	4.6	774,0	9.7	115,3	1.4	53,3	1.1	245,1	14.7
	- Crushing machine and presses	431,4		250,1		361,9		57,6		1,472,7		214,7		203,4		43,9		43,2		41,2	
84.28	OTHER MACHINES	323,6	0.4	619,7	2.4	180,7	1.1	913,6	7.2	566,9	4.9	691,0	4.7	295,4	2.6	744,4	9.3	704,4	13.9	131,6	7.9
	- Automatic watering-troughs	19,8		32,5		10,5		12,2		39,9		58,6		0,2		5,7		41,8		-	
	- Germination appliances	27,3		23,6		2,5		0,9		11,9		3,0		-		65,2		430,1		-	
	- Poultry incubators	42,1		0,5		1,9		30,9		1,8		127,4		25,9		77,4		17,9		11,7	
	- Parts	109,3		170,0		141,4		78,1		97,0		269,6		68,9		64,1		68,0		13,2	
84.29	MACHINERY USED IN BREAD GRAIN MILLING INDUSTRY AND OTHER	5,660,2	7.4	2,660,1	10.3	4,602,3	27.1	2,422,9	19.2	1,064,1	9.2	3,631,1	24.8	1,460,9	18.4	2,176,8	25.4	727,0	14.4	264,9	15.8
	- For mixing, cleaning and preparing grain prior to milling	588,9		118,1		191,3		291,2		115,2		299,7		2,8		-		30,6		23,9	
	- Grinding or crushing machinery	1,938,6		1,077,0		3,525,2		1,664,5		107,5		899,3		414,8		199,5		158,6		71,9	
	. weighing 5000 kg or less	1,042,3		982,9		752,7		1,664,5		107,5		495,5		291,8		89,6		6,4		71,9	
	- For sorting and separation flour and other milling products	511,4		474,5		175,5		22,1		143,7		331,2		5,4		216,8		82,9		-	
	- Parts	690,3		856,5		401,5		338,2		432,0		1.641,3		854,6		943,8		504,9		169,1	
87.01	TRACTORS	9,437,8	12.4	3,522,7	13.7	2,390,0	14.0	267,3	2.1	131,1	1.0	1,138,1	7.8	48,8	0.6	28,2	0.4	-	-	61,1	4.8
	- Four-wheeled tractors for agriculture	9,400,2		3,419,5		2,355,8		200,2		125,3		1,127,8		-		28,2		-		72,2	
	TOTAL	76,109,0	100.0	25,764,2	100.0	16,974,4	100.0	12,643,7	100.0	11,619,5	100.0	14,661,9	100.0	7,945,2	100.0	6,540,6	100.0	5,064,5	100.0	1,672,3	100.0

SOURCE: Centro de Informações Econômicas e Fiscais - CIEF, Ministério da Fazenda.

Table 10. Brazil: Exports of agricultural machines and implements - 1975-1984

(US$thousand FOB)

BTN	PRODUCT GROUP AND MAIN ITEMS	1975		1976		1977		1978		1979		1980		1981		1982		1983		1984	
82.01	HAND TOOLS FOR AGRICULTURE	2,578,9	10.4	1,178,5	6.5	3,008,6	5.2	3,136,5	4.1	3,533,5	3.5	3,844,9	2.7	4,605,4	2.8	4,382,1	4.2	6,915,2	12.7	5,815,5	6.0
	- Scythes and Sickles	21,7		23,3		49,2		87,6		64,3		78,3		96,1		50,7		343,6		44,1	
	- Spades, hoes, picks, shovels and mattocks	1,640,3		765,2		2,152,9		2,201,3		2,098,5		1,871,3		2,379,5		2,837,4		3,628,2		3,302,7	
	- Axes, hatchets and similars	479,2		168,7		321,6		387,2		820,4		893,5		1,021,7		710,4		240,3		659,9	
	- Bill hooks and machetes	266,9		120,8		229,0		241,3		332,1		736,9		745,6		403,9		2,409,4		1,351,8	
84.21	SPRAYERS, DUSTERS AND SIMILAR	1,845,7	7.4	1,276,7	7.1	3,569,0	6.1	5,364,1	7.0	4,754,0	4.7	6,378,1	4.4	6,029,3	3.7	2,931,5	2.8	2,387,7	4.4	3,466,5	3.6
	- Manual sprayers	602,7		380,6		956,6		1,189,8		1,192,7		1,747,4		2,083,5		797,6		603,1		1,739,9	
	- Power sprayers	798,2		671,5		2,023,0		3,434,3		2,648,9		3,229,5		2,898,3		1,370,4		909,5		1,726,6	
84.24	MACHINERY FOR SOIL PREPARATION OR CULTIVATION	4,493,3	18.1	3,748,5	20.8	6,882,9	11.8	7,013,4	9.1	12,886,5	12.8	20.563,9	14.2	13,722,9	8.4	13,428,6	12.8	4,877,6	9.0	24,745,3	25.3
	- Mouldboard ploughs	98,5		158,1		146,0		110,3		180,6		125,7		148,3		16,3		59,4		1,549,1	
	- Disc ploughs	1,032,0		895,0		1,493,5		1,018,4		1,345,1		2,530,7		1,765,5		1,386,9		1,399,1		2,761,9	
	- Ploughs fitted with shares or teeth	65,1		63,6		118,5		84,9		142,6		402,9		259,1		171,3		94,9		126,0	
	- Scarifiers	238,5		49,4		37,9		69,3		81,5		72,7		185,5		180,0		89,2		133,9	
	- Cultivators	88,6		82,4		427,6		242,6		192,6		171,3		367,6		62,9		83,0		59,3	
	- Weeders	-		-		2,5		10,9		0,1		961,1		275,4		339,2		339,7		9,6	
	- Disc Harrows	1,128,2		1,004,7		1,947,1		3,541,9		7,856,5		11,186,2		4,863,4		3,213,3		1,887,4		6,496,9	
	. Drawn	355,2		377,7		1,110,1		2,746,0		6,957,2		7,342,4		3,862,0		2,626,9		1,140,6		6,286,9	
	. Hidraulic lifting	642,4		626,9		818,9		766,6		852,4		1,267,1		659,3		539,0		730,8		210,0	
	- Seeders, combined seed and fertiliser distributor, planters	927,9		849,1		1,722,3		991,6		1,485,4		1,471,8		2,266,6		1,396,6		691,2		1,483,7	
	- Composed unit (tractor and implement) for soil preparation or cultivation	46,1		7,4		29,0		48,4		78,9		266,9		308,8		93,9		25,4		69,3	
	- Parts	647,2		340,6		479,1		453,5		799,5		1,825,6		1,732,7		5,699,0		8,7		11,549,9	
84.25	HARVESTING AND THRESHING MACHINERY AND SIMILAR	7,942,4	31.9	5,860,6	32.6	10,242,6	17.6	10,021,8	13.0	11,662,8	11.6	19,318,8	13.2	26,389,6	16.2	11,490,6	10.9	10,323,8	19.0	27,271,4	28.0
	- Combine harvester-threshers	5,108,5		3,610,2		6,525,8		6,551,1		8,752,1		12,846,3		17,792,2		6,298,8		5,440,8		13,980,6	
	. Self-propelled	4,793,2		2,805,1		5,088,5		6,211,3		8,473,9		12,234,7		16,490,9		5,936,4		5,361,0		12,121,4	
	. Other	315,3		805,1		1,437,3		339,8		278,2		611,6		1,301,3		362,5		79,8		1,859,2	
	- Maize threshers and similars	1,743,6		1,314,6		2,124,2		1,196,0		610,8		754,4		1,500,5		1,412,9		699,9		646,7	
	. Corn shellers	592,2		486,6		325,2		450,7		237,0		365,2		639,0		570,4		98,2		389,1	
	. Threshers	1,138,1		729,8		1.731,9		660,0		251,2		286,3		661,9		759,0		554,8		35,2	
	- Baling-presses	449,5		317,8		531,1		843,5		14,8		125,4		244,0		417,2		403,3		2,192,1	

Table 10. Brazil: Exports of agricultural machines and implements - 1975-1984 (continued)

(US$thousand FOB)

BTN	PRODUCT GROUP AND MAIN ITEMS	1975		1976		1977		1978		1979		1980		1981		1982		1983		1984	
	- Lawn mowers	27,0		40,6		79,5		62,6		169,2		585,2		692,9		169,2		862,4		270,4	
	. Other than motor-driven	13,1		4,5		23,0		13,2		105,6		369,0		380,3		58,9		298,5		195,3	
	. Motor-driven	13,9		36,1		56,5		49,4		63,6		216,2		312,6		110,3		563,9		79,1	
	- Cleaning, winnowing and sorting machines for grain, seed and similar	247,0		273,3		461,7		714,8		1,261,2		3,355,7		3,060,2		2,132,3		1,664,0		9,114,3	
	. For grading grains, seed and similar by photocell system	16,7		-		46,2		206,0		187,8		456,9		570,3		255,8		495,0		626,2	
	. Other types	87,4		240,0		83,4		171,8		509,0		1,774,1		333,9		1,197,7		515,4		1,787,4	
	- Machines for grading eggs, fruit, potatoes, onions and other products	1,7		94,6		142,0		49,3		210,0		476,9		276,2		30,2		95,0		72,2	
	- Parts	230,4		170,3		357,6		447,1		525,5		1,043,6		2,013,7		956,5		1,121,2		926,6	
84.26	DAIRY MACHINES	6,5	0.0	62,9	0.3	128,0	0.2	53,8	0.1	218,0	0.2	131,8	0.1	1,140,6	0.7	180,1	0.2	108,9	0.2	370,1	0.4
84.27	PRESSES, CRUSHERS AND OTHER MACHINERY FOR WINE MAKING AND SIMILAR	5,3	0.0	16,9	0.1	3,7	0.0	2,5	0.0	11,3	0.0	698,7	0.5	836,8	0.5	45,1	0.0	41,9	0.1	49,1	0.1
	- Crushing machines and presses	3,9		15,0		1,2		2,4		8,2		649,9		731,5		16,1		-		14,0	
84.28	OTHER MACHINES	412,7	1.7	1,170,4	6.5	1,175,1	2.0	1,312,2	1.7	1,390,8	1.4	1,709,5	1.2	2,277,5	1.4	1,635,6	1.6	1,616,2	3.0	1,657,1	1.7
	- Machines for grinding or milling grain	-		-		10,0		45,4		28,3		139,3		145,8		65,0		46,6		182,3	
	- Automatic watering-troughs	10,9		-		18,6		20,4		35,7		83,9		81,4		516,7		179,9		96,1	
	- Straw crushing machines	318,0		306,2		142,7		148,4		551,3		231,1		110,0		79,0		709,3		600,2	
	- Poultry incubators	4,2		-		105,1		106,2		92,1		168,2		118,6		3,9		93,7		-	
	- Brooders	5,3		8,5		-		17,2		89,2		237,8		215,2		15,8		27,7		22,9	
84.29	MACHINERY USED IN BREAD GRAIN MILLING INDUSTRY AND OTHER	1,432,2	5.8	1,084,5	6.0	1,830,6	3.1	1,832,4	2.4	3,132,6	3.1	2,510,2	1.7	5,157,3	3.3	5,979,0	5.3	4,747,5	8.6	2,427,9	2.5
	- For mixing, cleaning and preparing grain prior to milling	309,8		622,8		878,5		1,302,4		1,652,6		1,223,0		2,382,3		2,840,2		1,834,1		1,178,9	
	- Grinding or crushing machinery	77,4		11,6		85,6		57,3		47,6		216,3		1,408,7		616,0		1,642,1		398,9	
	. Weighing 5,000 kg or less	77,4		11,6		85,6		57,3		47,6		216,3		750,4		555,8		179,3		258,6	
	. Other	-		-		-		-		-		-		658,3		60,2		1,462,8		140,4	
	- For sorting and separating flour and other milling products	2,1		18,6		5,7		12,7		725,0		115,8		278,8		1.737,9		378,2		315,7	
	- Parts	99,7		116,9		133,4		70,9		211,2		125,5		326,2		255,4		209,2		247,5	
87.01	TRACTORS	6,167,8	24.7	3,631,4	20.1	31,518,0	54.0	48,130,4	62.6	63,160,6	62.7	89,851,8	62.0	102,477,5	63.0	65,454,3	62.2	23,357,1	43.0	31,466,9	32.0
	- Small-wheeled tractors (4 wheels) for use in agriculture and horticulture	195,6		186,0		342,5		537,2		858,4		321,6		6,7		15,0		24,8		22,8	
	- Two-wheeled tractors for use in agriculture and horticulture	126,2		304,2		192,2		253,1		401,7		777,9		410,8		242,6		298,5		485,5	
	- Four wheeled tractors for agriculture	5,846,0		3,139,2		30,983,3		47,340,1		61,900,5		88,752,3		102,060,0		65,196,7		23.073,8		30,958,6	
	TOTAL	24,884,8	100.0	18,030,4	100.0	58,358,5	100.0	76,867,1	100.0	100,750,1	100.0	145,007,7	100.0	162,638,9	100.0	105.126,9	100.0	54,375,9	100.0	97,269,8	100.0

Source: CACEX - Banco do Brasil.

3.2.3 Obstacles to production

On the surface there appears to be no major technical obstacles to the development of the AMI industry. The industry belongs to that part of Brazilian industry - metal working, transportation equipment, mechanical equipment and other capital goods - which is relatively well developed and sophisticated compared to other parts of the economy. Furthermore, the capital goods sector, of which the AMI industry is a part, is well integrated and has relatively little dependence on imported components and equipment. There is also a large, reasonably competitive (compared to Latin American standards) domestic market to stimulate production. This market has a large number of producers manufacturing a variety of products, and a wide sophisticated institutional network to foster the development of the industry.

However, the Brazilian AMI industry still appears to be hindered by the following obstacles to production:

- Lack of a coherent agricultural and livestock production policy;
- Lack of co-ordination of the policies directed towards the AMI industry;
- Lack of adequate levels of foreign exchange;
- Uncertainties caused by frequent changes in agricultural and national economic policies;
- The fact that many rural producers still lack the means to buy AMI products;
- Inefficiencies in product engineering;
- The distortionary effects of restrictive tariffs and protective arrangements.

First, the development of the Brazilian AMI industry has been hindered, perhaps more than anything else, by the lack of a coherent agricultural and livestock production policy. The economic health of Brazil's agricultural sector determines to a large extent the development of the AMI industry. Unfortunately Brazil's agricultural sector has suffered from a piecemeal and often incoherent agricultural and livestock production policy. Government policies and support have been largely directed towards the development of export crops at the expense of food products for domestic consumption. As a result of this, the productivity of domestic food products unlike export crops are low compared to international standards.

Brazilian experts claim that a more uniform and embracing agricultural and livestock policy, which included the promotion of agricultural products for domestic consumption, would have provided the stimulus for the appropriate development of the agricultural machinery industry.

Second, frequent changes in national economic policies and in particular agricultural policies have led to great uncertainty about future profitability for many AMI producers, and have have also greatly hindered the development of the industry.

Third, the development of the agricultural machinery industry in Brazil has been seriously hampered by the lack of co-ordination of national policies directed towards the industry. This is largely because of the fact that the industry lies at the interface between industry and agriculture which are controlled by different government ministeries that often do not co-ordinate their actions.[9/]

For example:

- Decisions about industrial policies come from the CDI, Industrial Development Council, an interministerial organization co-ordinated by the Ministry of Industry and Commerce; however, the AMI industry is considered a subsector of the automobile industry which has different priorities and concerns;

- Decisions about agricultural policy come from the Ministry of Agriculture which is more concerned about the production of food and the usage of other inputs, such as fertilizers, than agricultural machinery per se;

- Decisions about credit policies and agricultural prices come from the Treasury Ministry;

- Decisions about import/exports are handled by CACEX, the foreign commerce branch of the Bank of Brazil;

- Decisions about industrial price policies are the responsibility of the Treasury Ministry; and

- Decisions about national salaries are the responsibility of the Ministry of Labour and its associated bodies.

Fourth, rural producers still generally experience difficulties in obtaining the finance to acquire needed equipment. This is despite a variety of credit schemes for the purchase of AMI.

Fifth, another obstacle to the production of AMI is the low level of development of product engineering in Brazil.[10/] A recent survey of the industry found that product engineering, with the exception of 'drawing', is not very well developed.[11/] An analysis of small-sized enterprises (21-100 employees) and medium-sized enterprises (101-500 employees) which manufacture AMI reveals the following:

9/ "Brazilian National Paper on Agricultural Machinery", op.cit.

10/ This section is based on UNIDO/IS.607, Sectoral Working Paper Series No. 46, op.cit., pp 9-16.

11/ Ibid.

(a) Research

Fifty-seven per cent of the small-sized enterprises do not undertake any research work. The remaining small-sized enterprises also do not carry out research on AMI but try to obtain information and advice from work done by third parties or through technical assistance. In medium-sized enterprises the situation is better: 18.5 per cent of firms perform research using their own staff.

(b) Design

More than 50 per cent of small-sized enterprises use traditional products or models developed by third parties; 43 per cent try to improve the performance of products developed by third parties; only 5 per cent have developed their own designs.

(c) Measuring instrumentation

In small-sized enterprises 76 per cent carry out measurement activities (without calculation); 22 per cent carry out simple calculations; and, less than 2 per cent have developed their own measurement criteria at a recognized technical level.

In medium-sized enterprises there is much less 'measurement without calculation'; 22 per cent of firms have develped their own measurement criteria; and, almost 6 per cent measure and select materials according to accurate criteria.

(d) Drawing

Nearly two thirds of small-sized enterprises do not use any drawings or only use sketches; the remaining third prepare drawings with detailed information. More than 50 per cent of medium-sized enterprises prepare detailed drawings; the remainder either prepare complete working drawings of assemblies and specific details or only use a sketch.

(e) Testing

Two thirds of small-sized enterprises only carry out elementary working tests and the remaining enterprises undertake tests under actual working conditions. In medium-sized enterprises the situation is different; more than three quarters of them carry out tests in actual working conditions; 18 per cent only do elementary tests; and, 6 per cent have test laboratories and measuring equipment for testing prototypes.

(f) Technical assistance

Slightly over 50 per cent of the small-sized enterprises provide technical assistance and replace parts on request but have no manuals available; 41 per cent provide technical assistance together with the spare parts they keep in stock at the factory; the remaining enterprises operate through dealers that provide the technical assistance, keep spare parts in stock and have instruction manuals available. In medium-sized enterprises the above percentages are, 11.1 per cent, 25.9 per cent and 50 per cent

respectively, and the remaining enterprises provide periodical training to dealers' personnel on how to render technical assistance.[12/]

Sixth, Brazil's recent economic problems have led to a severe foreign exchange shortage. This shortage has been a severe obstacle for the development of Brazil's manufacturing industry and has also affected the AMI industry, though to a lesser extent. This is because the AMI does not rely as much on imported foreign machinery and components. Most of the machinery - about 80 per cent - is designed and built in Brazil.

Finally, there is also some evidence that, along with Brazil's manufacturing industry in general, the development of AMI industry is hampered by Brazil's system of import controls and other protectionist measures.[13/] The evidence suggests that Brazil's system of import controls, although beneficial in the 1960s and 1970s, are now retarding the growth of manufacturing industry and therefore the AMI industry by restricting the growth of exports. This is especially serious for the AMI since increased exports could be the means by which the industry could shake itself out of its present doldrums and achieve sustained growth.

3.3 Policies and programmes directed towards the AMI industry

3.3.1 Specific policies directed towards the AMI industry

The incentive given to agricultural mechanization in Brazil is basically the result of a domestic rural credit investment policy, personal income tax policy, and other legislation favourable to income derived from agricultural activities. Rural extension programmes are also available and could potentially encourage farmers toward a higher degree of mechanization.[14/]

(a) Rural credit

The primary goals of rural credit in Brazil are to increase the economic strength of small and medium-sized producers, and to stimulate the introduction of rational production methods, thereby increasing productivity and enhancing the standard of living of the rural population. To meet these goals, rural credit has been divided into specific categories dealing with credit for current expenditures, marketing, and investment, as well as credit for several special programmes.

12/ The survey also found difficulties with manufacturing engineering but these difficulties were not systematic or major. UNIDO/IS.607, Sectoral Working Paper Series No. 46, op.cit., pp. 16-18.

13/ See especially S. Teitel and F.E. Thoumi, "From Import Substitution to Exports: The Manufacturing Export Experience of Argentina and Brazil", Economic Development and Cultural Change, Vol. 34, No.3, 1986, pp. 455-490.

14/ This section is based on the report "The Brazilian Agricultural Machinery Industry" by Annibal Villela, Consultoria Econômica Ltd., Rio de Janeiro, Brazil, as well as information available from governmental sources. It is important to note that the data given in the next two sections relates to the period up to 1984.

Credit for investment purposes is necessary to encourage agricultural mechanization. Investment credit has been available for a variety of purposes, such as irrigation; electric power and telephone systems for rural areas; construction, remodeling or enlargement of permanent facilities; and, among other things, the acquisition of machines and agricultural implements. These machines and implements could be either new or revamped with a dealer warranty, and must have been produced domestically. Tractors, harvesting equipment and other agricultural machines, if not produced domestically, could only be financed if they were new and there are no similar products available domestically, or if they were imported through special government concessions. However, such cases have rarely occurred, since agricultural machinery imports have been negligible.

In 1983, finance periods for AMI ranged from five to twelve years. Tractors, harvesting equipment and other large machinery, however, had a maximum finance period of eight years, with a two year grace period. According to World Bank estimates,[15/] a five year credit given in 1975 at an interest rate of 15 per cent per annum would have resulted in a 54 per cent subsidy of the principal in 1983. Subsidies granted by Banco do Brasil in 1976 for the acquisition of tractors were approximately $US 250 million. This subsidy for the purchase of machines and equipment through government financing was considered excessive and too costly.[16/] In 1979 the rules governing rural credit were modified. In December 1982, a limit was put on credit for buying machines and equipment where interest payments were subsidized.

In 1983, the limit for subsidized credit was 100 MVR[17/] (approximately 3,500 dollars) per applicant, per year. On the other hand, machines powered by alternative, domestically available, energy sources - for example gas generator and alcohol - were granted special treatment, with no fixed credit limit. The same treatment was given to irrigation equipment and to expenses associated with the rehabilitation of used machines and equipment. These favoured credits could finance from 40 to 100 per cent of the total investment, depending on the status of the borrower (small, medium-sized, co-operatives, etc.) and pay an interest rate of 60 per cent per annum (for

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15/ World Bank, Latin America and the Caribbean Regional Office, "A Review of Agricultural Policies in Brazil", Washington, D.C. World Bank (1982), p.163.

16/ Recently, when the inflation rate in Brazil has exceeded 100 per cent per year, many people have defended the abolition of subsidies, including those for agriculture (in the form of negative interest rates), as a way to reduce price rises.

17/ The MVR or Highest Value of Reference has been one of the several account units used in the indexation of the Brazilian economy. In the past it has been readjusted every six months (in May and November) concomitantly with the minumum wage. Its value in 1983 was equivalent to $US 35.00.

the regions covered by SUDENE and SUDAM, 35 per cent per annum).[18/] If the financing exceeded 100 MVR, the interest rate jumped to 8 per cent per annum, plus monetary correction.[19/] When in recent years the inflation rate in Brazil has reached 100 per cent per annum, these credit terms (8 per cent per annum + monetary correction) have been considered onerous. Considering that the credit limit for the acquisition of agricultural machinery and implements was 100 MVR (except for the few special cases mentioned before) and taking into account that this represented only 25 per cent of the cost of a medium-sized wheel tractor in 1983, it is evident that, when compared to the situation prior to the 1979 reformulation of the rules governing rural credit, financial subsidies for buying machinery and implements, for all intents and purposes, ceased to exist in 1983. The decrease since 1980 in sales of large agricultural machines, as in the case of tractors, can be explained by, among other reasons, the increase in financing costs. In much the same way that a credit subsidy of almost 50 per cent of the value of a tractor may have induced an excessive demand in the past, the restrictions may have hindered the sales of agricultural machines, especially the most expensive ones.

Besides the general rural credit for investments, there have been several special rural credit programmes which also financed agricultural machinery. Credit within these special programmes was given only to applicants who fulfilled a series of requirements, such as explaining the proposed uses of the credit to the satisfaction of the authorities. This credit could cover up to 100 per cent of the budgeted value but was usually restricted to 100 MVR, except in cases where it was meant to finance mechanized patrols.[20/] The Government argued that mechanized patrols could make more efficient use of agricultural machinery and therefore deserved special treatment, regardless of whether these patrols were set up by co-operative organizations or by companies specialized in providing agricultural services (tilling, harvesting, cropdusting, etc.).

18/ SUDAM (Superintendence for the Development of the Amazon Region) and SUDENE (Superintendence for the Development of the Northeast Region) are federal agencies created with the specific purpose of fostering regional development. As part of the inventives to the regions covered by SUDAM and SUDENE, the interest rates charged in most government financing contracts in those regions are considerably lower than the rates charged in the rest of the country.

19/ The form of indexation most used in Brazil before 1984 was one that applied the monthly change in the nominal value of the ORTN (Indexed Treasury Bonds), which is established each month by the Monetary Authorities. In 1983 one ORTN was worth slightly over $US 8.00. Generally speaking, the term monetary correction means indexation through the variation of the ORTN.

20/ Mechanized patrols were a set of agricultural machines and implements owned by an entity (co-operatives, firms, etc.) that rendered services to farmers in a certain region.

One of the special programmes instigated, PROFIR (Irrigation Equipment Acquisition Financing Programme), was particularly interesting. The only limit established by PROFIR - 400 MVR - was for purchasing machines and equipment which consumed imported fuel. A credit limit was imposed in cases where electricity or non-conventional energy sources were used. The financing terms were for six years, with a two year grace period and interest rates of 60 per cent per annum (25 per cent for the regions covered by SUDAM and SUDENE). The credit terms were the same as for the general rural credit but, as there was no credit limit, they represented a sizeable incentive, especially if an inflation rate surpassing 100 per cent was taken into account.

(b) Personal income tax exemption for rural producers

The Federal Government provided strong incentives for agricultural activities in general, and the acquisition of equipment in particular by income tax concessions.[21/] In 1970 and in subsequent years, the taxable income for rural producers was determined as follows. First, the gross income of the agricultural producer was determined. Second, all current expenses, such as taxes, interest and amortization, payroll expenses, etc., were deducted. Finally, investment expenses were deducted. The investment expenses relevant to this study are listed below:

Group of investments No. 2 - coefficient = 5
Items 01 - tractors
02 - implements and equipment
03 - trucks and all purpose vehicles
04 - engines and generators
05 - agricultural devices
06 - cropduster planes (domestically manufactured).

Group of investments No. 4 - coefficient = 2
Items 01 - equipment
02 - animal drawn vehicles
03 - draft animals
04 - implements that last at least 1 year.

The coefficient for implements and equipment (investments no.2, item 02) meant that the expense incurred in the acquisition of a tractor, for example, could be deducted five times from the rural producer's gross income. In the case of animal drawn vehicles, on the other hand, the expense incurred could only be deducted twice since this category only has a coefficient of two. This demonstrated a clear incentive towards the acquisition of more sophisticated equipment.

In determining the rural producer's taxable income, the legislation stipulated that net income after all deductions be divided by two. Taxable

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21/ Decree No. 902/1969, Decree No. 1074/1970, Decree No. 76186/1975, and Decree No. 85450/1980.

net income was limited to five per cent of gross income, which meant that the producer could claim a lower value if his established net income after all deductions was still above the five per cent value. Thus, after so many deductions, it was quite possible for the rural producer to show a loss for taxable purposes. In such a case the loss for a given year could be compensated in the statements for the three subsequent years. In the event that the taxable net income was positive, it was then taxed according to the income tax schedule in force in the country for all types of income. This schedule was graded progressively up to the 55 per cent bracket. In the case of agricultural enterprises, the coefficients used for the deduction of the expenses were the same as the ones mentioned above. The operational result was taxed at six percent, in contrast to 30 to 35 per cent for non-agricultural enterprises.

3.3.2 Existing programmes directed towards the AMI industry

(a) Technical assistance programmes[22/]

The two major institutions providing technical agricultural assistance in Brazil are EMBRATER (Brazilian Technical Assistance and Rural Extension Enterprise), and EMPRAPA (Brazilian Agricultural Research Enterprise). These organizations undertake research, either directly or through agreements with other institutions, and provide technical assistance to producers. They have no explicit policies pertaining to agricultural mechanization; their goals, however, are to strengthen the rural producer's productive capacity, to encourage the introduction of rational production methods, and to improve the standard of living in rural areas of the country. The efforts made by these institutions have been generally successful in increasing the use of agricultural machinery and implements. In addition to EMBRATER and EMPRAPA's activities there are specific technical assistance programmes directed towards the AMI industry.

The AGRITEC programme

In order to improve their technological capability some Brazilian small and medium-sized firms asked the Government to establish a technical assistance (TA) programme. In response, the Government, in 1980, began to explore ways in which it might offer TA to these firms through the Ministry of Industry and Commerce with STI; its Industrial Technology Secretariat acting as the co-ordinating body. As a result of these efforts the AGRITEC programme was developed.

The AGRITEC TA programme to the AMI industry consists of three subprogrammes:

- A product engineering subprogramme which deals with technical evaluation of agricultural equipment to improve mechanical design and upgrade the technological level of products;

22/ This section is based on the "Brazilian National Paper on Agricultural Machinery", op.cit.

- A manufacturing engineering subprogramme which evaluates current metalworking industrial processes to suggest ways in which they might be improved; and

- A basic technology subprogramme which is concerned with standardization, industrial quality, patent systems and technological information.

A prominent feature of the mechanization of farming in Brazil has been the application of powered machinery to the land, especially tractors. It is not suprising, therefore, that the first research project carried out within AGRITEC was a technological evaluation of Brazilian agricultural tractors. The Agronomical Institute of Campinas (IAC) a Sao Paulo State agency, was asked by STI to devise a tractor evaluation scheme based on Brazilian and international testing standards. STI and other associated governmental agencies then purchased tractors and analysed, among others, the following characteristics: static weight distribution, drive characteristics, the relationship between engine power and drawbar power, power at hydraulics, and workplace design (with emphasis on seating, controls, ease of access and the operator's field of vision).

Another important research project is also being carried out by IAC which analyses the performance of Brazilian sowing/seeding machines. A similar project is being undertaken by the Luiz de Queiroz Agronomical College (ESALQ) of the University of Sao Paulo which involves an evaluation of the operational performance of mounted sugar-ca.e loaders.

AGRITEC has recently finished a research project which involved the development of engineering guidelines for manufacturing. Within the scope of this project, 123 small and medium-sized firms[23/] in the South-East and Southern regions of the country were studied to evaluate the technological levels of their major manufacturing unitary operations - that is, metal sheeting and piping, welding, heat-treatment, foundry, assembly, painting and testing operations. This work pointed out serious problems in the areas of casting, heat-treatment, painting, testing and inspection.

The AGRITEC programme is especially concerned with painting procedures and quality control. Within the programme, the Technological Research Institute of Sao Paulo State (IPI) carried out a short study of eight industries making agricultural equipment in the hinterland of the state. This study closely examined painting procedures and quality control systems. The results of the study are being used to establish a specific TA programme in areas of painting procedures and quality control systems. This TA programme is to be carried out within the next few years.

23/ Firms were classified as follows: - small-sized firms: 21 to 100 employees and medium-sized firms: 101 to 500 employees. Firms with less than 21 employees were classified as micro-firms.

3.3.3 National policies which might aid the AMI industry but are not specific to the industry

The Brazilian AMI industry receives help, albeit indirect, from the Brazilian system of import controls and export incentives. The import controls are meant to protect Brazilian industry from potentially harmful foreign competition, and the export incentives are intended as an added inducement to domestic producers.[24/]

(a) System of import controls

Imports are divided into three categories: those goods which require an import license, or "guia", from the Bank of Brazil's Foreign Trade Department (Cacex); a limited number of goods which do not require a guia or any other type of Cacex documents; and those goods which are prohibited from coming into the country indefinitely or temporarily by various ad hoc laws.

(i) The system of import licenses: the "guia" system

Nearly every imported good requires a "guia". A "guia" usually must be obtained before goods are disembarked. They are valid for 60, 90 or 180 days depending on the particular type of import. For example, a "guia" is granted for 90 days for raw materials and components which will eventually be incorporated into Brazilian manufactured products; for machinery, spare parts and accessories the guia is valid for 180 days. the requirement of a guia is often used to reduce the flow of imports without actually refusing licenses: the officials responsible simply increase the time taken to process an application for a guia. For example, to slow an application Cacex officials can merely ask for further information before a license is granted. This slowing down of the processing of guia applications is known as "operacao tartaruga" - working at a turtle's pace.

(ii) Brazil's unofficial import quota system

Brazil's Foreign Trade Department, Cacex, has adopted several ad hoc methods to try and control imports. In 1981, for example, all manufacturers were required to keep the value of their imports to the arithmetic average of the value of imports in 1979 and 1980. All manufacturers with imports with a value of at least $US 100,000 had to submit an import plan to Cacex; those showing imports greater than the value of their 1979-80 average had to provide a statement from their particular industry associations detailing why this excess was justified. If Cacex viewed the justifications given for the excess value of imports as inadequate, it would reject a manufacturer's import plans.

(iii) System of finance for capital goods

Of particular relevance to the Brazilian AMI industry are imports of capital goods, since these could include agricultural machinery and implements. In September 1980, Brazil's central bank introduced rules intended to significantly reduce imports of capital goods. These new rules

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24/ This section is based on, Business International Corporation, Trading in Latin America: The Impact of Changing Policies, New York, 1981.

were contained in the bank's Resolution 638. This required medium and long term (from one to eight years) offshore financing for nearly all imported machinery and equipment, which included components and spare parts.

Under Resolution 638, a schedule of financing terms was established for imports according to their value. Any imported machinery and equipment between $US 100,000 and $US 300,000 in value had to be financed from abroad on terms requiring at least three years. For imports between $US 300,000 and $US 1 million, firms were required to have terms of at least five years; for orders of one to fifteen million dollars, terms of seven years were required. Imports valued at over five million had to be financed on terms of at least eight years (usually eight years). For imported components and parts the minimum term required for financing was one year.

There were of course some exceptions to the requirements of Resolution 638 detailed above; most notably imported components were exempt if they were to be used in one of Brazil's export incentive programmes, or token imports were justified by Brazil's National Research Council.

(iv) Taxes levied on foreign exchange

Since April 1980, Brazil has extended its tax on financial operations (Imposto Sobre Operacoes Financeiras - ISOF) to imports. This tax, ISOF, is levied on foreign exchange used to pay for imported goods and services. The tax rate was initially fifteen percent of the local value of the amount exchanged, but was increased to 25 per cent in 1981.

(v) Tariff rates

In general, Brazilian tariffs are ad valorem tariffs which range from zero to 205 per cent of the C.I.F. price. The tariff rate for imported raw materials and finished essential products that are not produced locally is between zero and 37 per cent; for products which are granted special protection, tariff levels are between 15 and 70 per cent; for luxury goods and other nonessential items tariff rates are 64 to 205 per cent.

(vi) The "similars" rule

Brazil operates a system of similars. Under this system anyone wishing to import foreign products (usually machinery) has to prove that there are no reasonable substitutes available locally or which can be produced by domestic manufacturers.

(vii) Local-content restrictions

Brazil has very strong local-content regulations which attempt to reduce the incentive to obtain components from abroad. There are many programmes geared to increasing the percentage of domestically made parts and components in manufactured goods. In the case of agricultural machinery there is a special incentive programme for increasing the proportion of locally produced materials in crawler tractors. Local-content requirements for capital goods can often reach 80 to 90 (for harvesters it is 93 per cent).

(viii) Exchange rate changes

Brazil has often resorted to devaluation of its currency - the cruzeiro - as one method of curbing imports. These devaluations have often been used with restrictive monetary, fiscal and credit policies to restrain domestic demand and curb imports with the hope of obtaining a surplus on the balance of trade.

Brazil has used both mini-devaluations and major devaluations. Usually the mini-devaluations have been done according to a formula which assesses the difference between domestic and trade-weighted foreign inflation.

Prior to 1979, mini-devaluations were the predominant form of devaluation used. The exchange rate was adjusted at frequent intervals, usually monthly, depending on the relationship between the performance of the domestic price level and that of foreign trade. In December 1979 and February 1983 there were two major devaluations of the currency of roughly 30 per cent against the dollar. Between these major devaluations and after them, there have also been mini-devaluations of more frequent intervals (weekly or fortnightly). For example, the exchange rate of the cruzeiro was 42.3 cruzeiros to the dollar in mid December 1979, by late November 1981 the official exchange rate was 118 cruzeiros to the dollar. In May 1982 this changed to 155 cruzeiros to the dollar.

The major devaluation of the currency on February 1983 changed the exchange rate from 292.5 cruzeiros to the dollar to 380.5 cruzeiros. After the major devaluation in February 1983 there were again mini-devaluations of the currency which brought the currency to 481 to the dollar in early June 1983.[25/]

Since 1983 Brazil has see-sawed between major and mini-devaluations of the currency. The Cruzado Plan in February 1986 knocked off three noughts off the Brazilian currency, to create a new one, the cruzado. But as Brazil's economic situation became increasingly precarious in late 1986, the Government allowed some mini-devaluations of the currency.[26/]

(b) The Brazilian system of export incentives

(i) Export controls

As with imports, Brazil controls exports very closely. All exports must be licensed, and companies who want to export goods must register with Cacex's "Cadastro de Exportadores e Importadores". There are plans to eliminate the "guia de exportacao" for manufactured products and only have guias for raw materials and farm products. Under these plans, manufacturers may export goods but must then inform Cacex within a specified time period, after which Cacex would grant a license. These plans have not yet been implemented and at present exporters still require guias.

25/ The Economist Intelligence Unit, Quarterly Economic Review of Brazil, Annual Supplement 1983, p.8.

26/ The Economist, "Brazil: Survey", 25 April, 1987, pp.9-10.

For certain products Cacex must be informed even before a company applies for an export license. The list of products for which pre-approval is required changes but has included silk, pig iron, aluminium, and many other metals.

(ii) Export incentives

Brazil gives export incentives to industry in general and thus indirectly to the Brazilian AMI industry. Exporters can deduct all their export earnings from their taxable profits. They can also deduct from their taxable income all expenditures made overseas related to selling exports (e.g. advertising and promotion). The Government also makes available low-cost credit to exporters.

(iii) Specific export incentive programmes: Befiex and Ciex

Befiex and Ciex are two specific programmes established by the Brazilian Ministry of Industry and Commerce to encourage exports. Under the Befiex programme (beneficios fiscais para exportacao) export manufacturers receive between 70 and 90 per cent reductions in duties and taxes on imports of either new or used equipment and machinery. In addition, exporters also receive 50 per cent reductions in taxes and duties on imported raw materials and components. The imports that are eligible under the Befiex system must not comprise more than one third of a manufacturer's F.O.B. exports in a given year. On imported goods and components used in goods produced for re-export, manufacturers may receive a temporary suspension of import duties, partial reimbursement of duties paid, or total reimbursement of duties, depending on the circumstances. However, the total value of imports in a given year cannot be greater than 50 per cent of the F.O.B. value of exports. The Befiex programme is of benefit mainly to manufacturers with large projects producing primarily for export.

The Ciex programme was established in 1976. Ciex, unlike the Befiex programme, is designed for small and medium-sized manufacturers. Under the Ciex programme firms can receive up to 90 per cent reductions in duties and taxes on imported capital machinery.

In order to be eligible for either the Befiex or Ciex programmes manufacturers must show a positive trade balance (i.e. export more than they import). Ciex imports must still satisfy the "similars" law that was discussed earlier in connection with import controls. Under the Befiex programme imports are not subject to the "similars" rule but manufacturers still must state the origin of their equipment.

(iv) Export financing

The Bank of Brazil (Banco do Brasil) provides export credit through its General Credit Department (Crege) for as much as 180 days. Export credit for longer periods is provided by Cacex (the Bank of Brazil's Foreign Trade Department). Cacex also provides, via a Special Export Financing Fund (Finex) using funds from the Inter-American Development Bank, up to 80 per cent financing for one to five year exports of capital goods to other Latin American countries. Finex makes available post-shipment credits for capital goods and consumer durables amounting to as much as 85 per cent of C.I.F. invoice values. These loans are for between 180 days and five years and must be repaid in convertible foreign currencies.

There are many other private sources of export finance, the most important of which are the commercial banks. Exporters can obtain export financing and refinancing from commercial banks based on their export volume in the year prior to their credit application. The loans are for a maximum of one year. Maximum interest payments plus bank commissions charged to firms total 22.5 per cent per year. If a manufacturer does not meet his stated export targets, he must pay the difference between 22.5 per cent and current bank lending rates in Brazil. Private commercial bank financing has become a major source of funds for financing exports.

(v) Exchange rate policy

As described earlier, in section 3.3.3 (a), Brazil uses adjustments in its exchange rate, via major and mini-devaluations, to curb imports and especially to stimulate exports.

3.3.4 Institutional mechanisms to foster the development of AMI[27/]

(a) Institutional mechanisms for standardization and quality control in industry in general

As the industrial and technological base widens in a developing country, there is a greater need for accurate measurements and standardization of products. In the context of AMI, the widening of the industrial and technological base in a developing country makes the domestic market more competitive and this, in turn, increases the demand for better quality and standardized AMI products. The Brazilian authorities are making considerable efforts to increase the number of technical standards enacted and to develop an appropriate system of quality certification. One of the Government's short-term objectives is to establish a new attitude to quality on the part of firms by means of investments which mature quickly, and by encouraging a decrease in production costs through the elimination of reworking and losses. In the longer term, the Government hopes to achieve a new positive attitude towards quality in the AMI industry. One of the ways the Government intends to do this is to build better links between industry, universities, technological centres and government agencies. At present, these links are still fragile. More specifically, the intention is to build up a large and diverse infrastructure to support the development of standardization and quality control.

One of the most important branches of this infrastructure is the National System of Metrology, Standardization and Industrial Quality - SINMETRO. It was established by the Brazilian Government with the task of formulating and executing the national policies of metrology, industrial standardization, and quality certification for industrial products. SINMETRO was created by the Federal Law No. 5966 in December, 1973. Its administrative body is CONMETRO - the National Council for Metrology, Standardization and Industrial Quality, and its executive body is INMETRO - the National Institute for Metrology, Standardization and Industrial Quality.

27/ This section is based on the "Brazilian National Paper on Agricultural Machinery", op.cit.

The basic scope of CONMETRO is as follows:

- To formulate, co-ordinate and supervise Brazilian policies on metrology, industrial standardization and certification of quality for industrial goods, harmonizing the interests of the Government, industrial sectors and consumers;
- To assure uniformity and rationality in the application of units of measurement used through the country;
- To promote voluntary standardization activities;
- To establish standards related to industrial materials and products; and
- To co-ordinate Brazilian participation in international activities, in the fields of industrial standardization and quality control.

The Minister of State for Industry and Commerce is the President of CONMETRO, and the Industrial Technology Secretariat - STI operates as its executive secretary. Several state-ministries, the National Confederation of Industry, the National Confederation of Commerce and Consumers' representatives are also members of CONMETRO.

INMETRO - the executive body of the system - operates through co-ordination committees and was established to co-ordinate the standardization and quality activities in specific sectors and to harmonize them at the Government level.

The arrangement chart of SINMETRO is given in figure 1. As can be seen, there are three subsystems within SINMETRO:

- The metrological subsystem;
- The standardization subsystem;
- The industrial quality subsystem.

Activities concerning the agricultural machinery industry are carried out mainly within the two last subsystems.

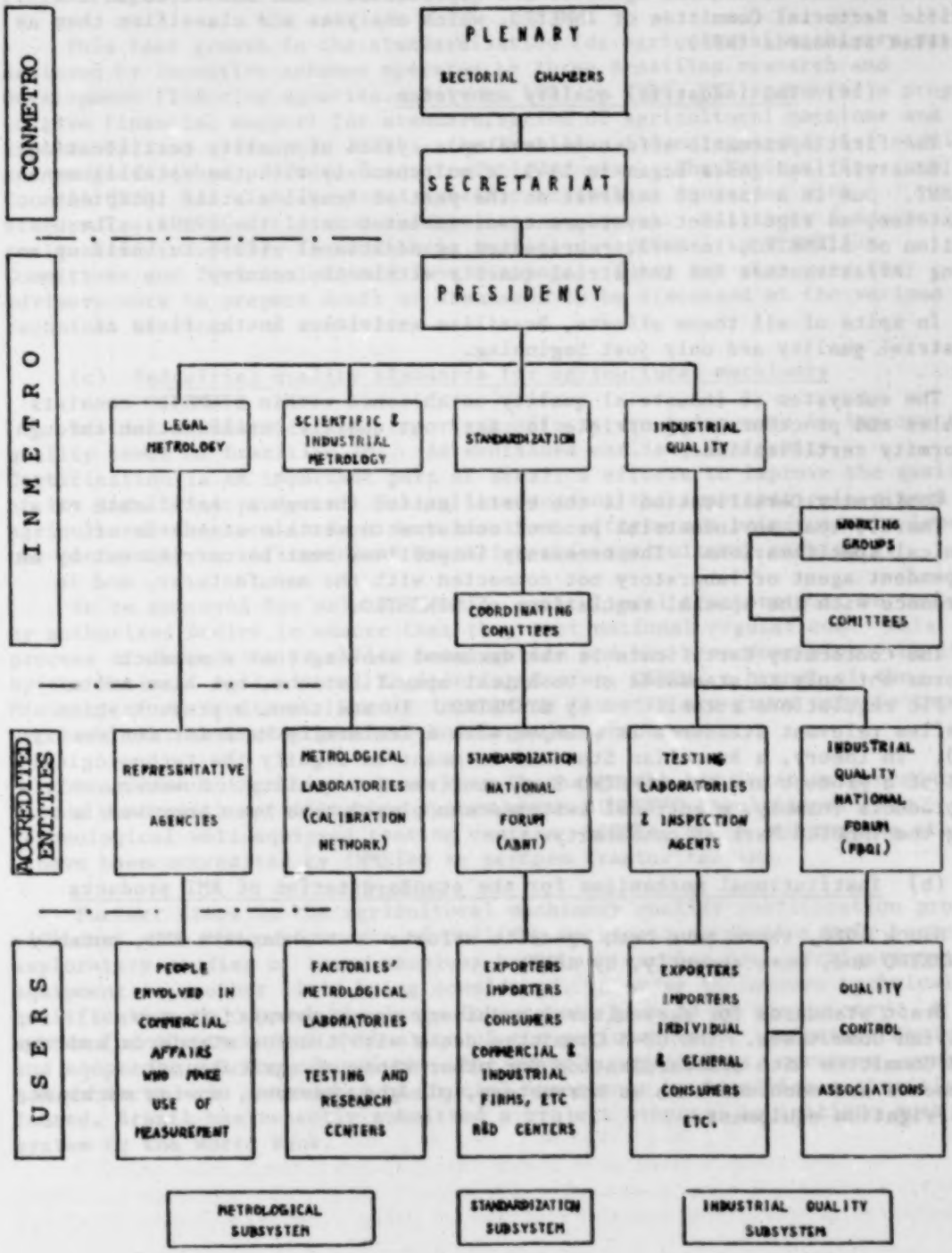
(i) The industrial standardization subsystem

There are two branches of this subsystem: the Sectorial Co-ordination Committees (governmental bodies for standardization) and ABNT - Brazilian Association for Technical Standardization, a private and national forum for standardization.

The Sectorial Co-ordination Committee for agricultural machinery and implements, known as GOAGRI, was created in 1984 and is doing important work with respect to the standardization of AMI. Those activities will be commented on later.

The Sectorial Committees of ABNT was founded in September 1940 as a private organization, but became a public body in 1962. Since its founding, ABNT is developing technical documents and disseminating technical information concerned with standardization. Within the subsystem, ABNT continues to play an important role and produces many technical standards.

Figure 1. Arrangement chart of SINMETRO



Work in ABNT is voluntary and is carried out by about 4,000 support staff. Consensus within the community is achieved through the work of 23 Brazilian Committees (CBs) within ABNT, which control about 700 technical commissions.

ABNT standards, previously approved by the members of Brazilian Committees - where consumers, producers, scientific and technological institutions and Government agencies are represented - are submitted to the specific Sectorial Committee of INMETRO, which analyzes and classifies them as Brazilian Standards (NBR).

(ii) The industrial quality subsystem

The first systematic effort to develop a system of quality certification for industrialized goods began in 1940, simultaneously with the establishment of ABNT. Due to a lack of interest on the part of Brazil's still incipient industries, no significant development was achieved until the 1960s. The creation of SINMETRO, in 1973, represented an additional effort to build up a strong infrastructure for industrial quality within the country.

In spite of all these efforts, Brazilian activities in the field of industrial quality are only just beginning.

The subsystem of industrial quality established within SINMETRO consists of rules and procedures appropriate to carry out quality certification through conformity certification.

Conformity Certification is the certification through a certificate or a seal (mark), that an industrial product conforms to certain standards or technical specifications. The necessary inspections must be carried out by an independent agent or laboratory not connected with the manufacturer, and in accordance with the special regulations of SINMETRO.

The Conformity Certificate is the document showing that a product conforms not only to standards or technical specifications, but also meets specific regulations established by SINMETRO. In addition, a product which satisfies relevant standards is stamped with a Conformity Mark (or Conformity Seal). In theory, a Brazilian Standard is meant to signify the technological level of a product and the INMETRO Seal confirms its quality. However, only a few products (namely, electrical switches and plugs) have been approved for using the INMETRO Mark of conformity.

(b) Institutional mechanisms for the standardization of AMI products

Since 1980, there have been specific efforts to standardize AMI, notably by INMETRO and, more recently, by ABNT.

Draft standards for agricultural machinery are elaborated in two Brazilian Committees. The CB-5 Committee deals with tractor standards and the CB-12 Committee with standardization for other kinds of agricultural implements and machines such as harvesters, ploughs, harrows, sowing machines, and irrigation equipment.

INMETRO has a provisionary standardization plan based on the results of a study undertaken by CIENTEC - the Scientific and Technological Institute of the State of Rio Grande do Sul in the Southern Region of Brazil. The draft standardization plan is now being revised to reflect basic needs identified during the last few years.

Table 11 shows the extent of Brazil's standardization activities in the field of agricultural machines and implements.

This fast growth in the standardization for agricultural machinery was achieved by incentive schemes operated by three Brazilian research and development financing agencies. Between 1981 to 1983, STI sponsored a program to give financial support for standardization of agricultural machines and implements, and since then FINEP - the Brazilian financing agency for studies and projects - has provided funds for this program. The National Research Council CNPQ, has also sponsored specific activities concerned with standardization of irrigation and drainage equipment. All those funds assist small-sized industries to send their qualified personnel to Brazilian Committees and Technical Commissions meetings. Funds are also used for advisory work to prepare draft of standards to be discussed at the various technical meetings and committees.

(c) Industrial quality standards for agricultural machinery

Besides standardization, important efforts are being made to improve the quality level of Brazilian AMI. As mentioned earlier, Conformity Certification is an important part of Brazil's efforts to improve the quality of its industrial products. Taking into account the important role played by agricultural tractors in farm mechanization, efforts are being made to improve the conformity certification of Brazilian-made agricultural machinery.

To be approved for sale in Brazil, agricultural tractors must be tested by authorized bodies to ensure that they meet national regulations. This process of inspection is called homologation and has been done since the 1950s by the National Agricultural Engineering Center, CENEA, a branch of the Ministry of Agriculture. Credit incentives for sale are given only to those tractors that have undergone the homologation process.

Brazilian authorities are working to change the homologation procedures into a conformity certification system under SINMETRO regulations. Two technological well-equipped testing centers - CENEA, and a IAC testing station - have been accredited by INMETRO to perform tractor testing.

Further steps in the agricultural machinery quality certification process will deal with the performance of drilling machines; at present only basic or exploratory studies of these machines have been carried out. Irrigation equipment is another field being considered, in order to improve technical qualification to support the large investments planned in the country. A system for the technical evaluation of the performance of irrigation devices and equpment, and for components - for example, sprinklers, sprayers, pumps, and so forth - is considered of crucial importance by Brazilian authorities. Indeed, Brazil has recently submitted a project proposal to initiate such a system to the World Bank.

Table 11. Standards available for agricultural machines and implements (31 October 1986)

ABNT - BRAZILIAN COMITTEE NUMBER 12

TECHNICAL COMISSIONS	ABNT STANDARDS		NBR STANDARDS		TOTAL (ABNT + NBR)
	under writing	draft standards available	under registr.	Brazilian standards available	
HARVESTING MACHINES	2	2	1	-	5
HAY-MAKING MACHINES	-	2	-	-	2
SILOS AND DRYERS	-	2	-	-	2
SOIL TILLAGE	4	1	3	4	12
DRILLING MACHINES	5	1	-	2	8
SAFETY & ERGONOMY	-	5	-	2	7
IRRIGATION & DRAINAGE	13	9	4	9	35
THRESHING MACHINES	1	-	-	-	1
PEST-CONTROL MACHINES	1	-	-	-	1
T O T A L	26	22	8	17	73
	48		25		

Source: Brazilian National Paper on Agricultural Machinery, p.17.

(d) Technical information network

A broad program to support scientific and technological development has been carried out by the Brazilian Government since 1984. The program - called PADCT has been supported by funds from the World Bank and involves the establishment of a national technological information network of 22 technical information centers or nuclei.

With regard to agricultural machines and implements industry, two nuclei are of special importance: the Basic Nucleus for Information on Technical Standards (SINORTEC) and the Agricultural Machinery Sectorial Information Nucleus (NSI/MA).

SINORTEC has the following objectives:

- To organize and integrate initiatives in the field of technical information through an integrated development of collections of documents, registration of compatible equipment, exchanges of experiences, extensions of existing services, and soon, in the principal institutions involved with standardization;

- To provide technical assistance to industry with respect to the identification, localization, equivalence and application of national, foreign and international standards.

SINORTEC's activities are based on the work being done at the three Brazilian organizations, INMETRO, ABNT and IPT. SINORTEC objectives are closely linked with NSI/MA objectives. NSI/MA is the specific information nucleus for agricultural machinery industry and its work is carried out by IPT - in Sao Paulo State, and by CIENTEC, in the State of Rio Grande do Sul. Working together, IPT and CIENTEC offer technical information to the Brazilian agricultural machinery industry by means of:

- A system of technical information on products, services and producers;

- Technical papers, as a periodical information bulletin (send free-of-charge to 2,000 users), specialized publicatious (monographies) and technical handbooks;

- Appropriate services to users, question-answering, selective dissemination of information, and retrospective retrieval of documents;

- Bibliographical processing.

This technical information network is an important tool for the industrial sector to rationalize production processes ard to carry out product innovations.

3.3.5 Effects of existing policies and programmes

(a) The effects of credit subsidies for agricultural mechanization

Credits with subsidized interest rates have been a major tool of Brazilian agricultural policy since 1972. In some years, for example 1975, the total amount of credit given to the agricultural sector actually exceeded

the net value of output. In addition, these credits have been heavily subsidized with negative interest rates. During 1975-1979, approximately 80 per cent of agricultural credits went to six crops: soybeans, rice, wheat, corn, coffee and sugar cane. A 1979 study by Brazil's Instituto de Economia Agricola, based on a sample of 6,000 farms in Sao Paulo in 1977, showed that the larger farms obtained proportionately more of the available credit. In addition, related studies by Brazil's Central Bank revealed that credit was also concentrated in particular areas.[28/]

There is also some evidence that credit was not always used for the proper purposes and that they encouraged excessive mechanization and fertilizer use but did not necessarily lead to increased production or yields.[29/]

From another important study it appears that Brazil's system of agricultural credit subsidies has led to a distortion in the prices of factors of production, especially the price of capital.[30/] This distortion in the prices of factors of production has, according to the study, encouraged the substitution of artificially cheap capital for labour, and at the same time, a shift in production from the more labour-intensive farms and regions to those farms and regions where labour costs were much higher. The detailed conclusions of the study were as follows:

- Subsidized credit in Brazil has contributed to the widening of income differentials between regions;

- As in many developing countries, the decision of governments to offer subsidies for agricultural mechanization was prompted by a small group of large, rich farmers and importers of heavy agricultural machinery. It appears that it was these groups which were the major beneficiaries of agricultural mechanization credits during the period under examination, 1960-1971;

- The employment effects of agricultural subsidies depends on the elasticity of substitution of capital for labour - loosely speaking, the ease with which capital can be substituted for labour. If this elasticity is low - that is capital cannot be substituted for labour

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28/ M. Bekerman "The Impact of the international environment on Brazil: From 'Miracle' to Recession", World Prices and Development, S. Griffith-Jones and C. Harvey, eds., Gower Publishing Co., 1985, p. 136.

29/ World Bank, World Development Report 1986, New York, Oxford University Press, 1986, pp. 98-99.

30/ Ibid. See also J.H. Sanders and V.W. Ruttan, "Biased Choice of Technology in Brazilian Agriculture"in Induced Innovation. H. Binswanger, V. Ruttan, and others (eds.), John Hopkins University Press, Baltimore, 1978.

very easily - then, in theory, the major effects of credits would be to reduce production costs at the farm level and to increase output at the sector level;[31/]

If, on the other hand, the elasticity of substitution is relatively high, then subsidizing credit would have a large labour displacement effect. The study finds that elasticities of substitution are indeed high - ranging from 1.5 in 1950 to 1.9 in 1960 - implying a large labour displacement effect;

- The elasticity of substitution is much lower for large farms than for small ones. In 1960, in Sao Paulo, the elasticity of substitution for large farms was 0.4 whereas for all farms in Brazil the elasticity was 1.9. Thus large farms were relatively more interested in subsidies for the purchase of machinery to save labour costs;

- The study also finds that the political power of a small group of large, rich farmers in the South (Sao Paulo) enabled them to obtain mechanization subsidies from the Government to substitute capital for relatively scarce labour. This led to a shift in comparative advantagein the production of sugar cane from the low-wage, labour-intensive North to the high-wage, labour-scarce South. In 1950, the Northeast (Pernambuco) produced 13,727 thousand tons of sugarcane, the South (Sao Paulo) produced 6,914 thousand tons, and the total production of both regions was 12,481 thousand tons. By 1960 these figures changed to 37,147 in the North, 38,296 in the South, and 46,424 for total production. This increase in the production of sugarcane in the South occurred at the same time the South, especially the Sao Paulo sugar-producing region, was undergoing rapid mechanization of its agricultural operations.

The above-mentioned study has been quoted widely.[32/]

31/ The rationale for these effects are quite straightforward. Agricultural credit for the purchase of machinery makes the price of machinery (capital) relatively cheaper. With credit subsidies, farmers can produce exactly the same output as before but for a lower cost, using the same amount of machinery (capital) and labour. This is because machinery now costs them relatively less. In addition, output increases due to the increased profitability of production as a result of the cost savings brought about by the credit subsidies. See, H.P. Binswanger, "The Microeconomics of Induced Technical Change," in Induced Innovation, op.cit., pp. 91-128.

32/ The results of this study have especially been quoted in the work of H. Binswanger and his colleagues at the World Bank. See, inter alia, H. Binswanger "Agricultural Mechanization: A Comparative Historical Perspective", World Bank Staff Working Paper 673, Washington, D.C., 1984, and H. Binswanger and G. Donovan. Agricultural Mechanization: Issues and Policies, Washington D.C., World Bank Report No. 6470, October 30, 1986.

However, even if the methodology of the study is not questioned, the study's conclusions must be interpreted in their proper perspective. The study does not suggest that credit subsidies for all types of mechanization are inappropriate - only those for the purchase of tractors.[33/] It is not clear that credit subsidies for animal drawn machinery and/or hand implements would have led to similar unfavourable effects. Nor can it be inferred from this study alone that credits for the purchase of tractors given in the period 1960-1971 would lead to the same effects in the 1980s. On the other hand, similar effects of subsidies have been found in other countries in more recent time periods.[34/]

(b) Effects of Brazil's system of import controls and export incentives

The Brazilian system of import controls and incentives appears to have been very successful in achieving its goals of curbing imports.[35/] Imports of capital machinery and equipment have decreased to almost zero. Under the protection of these controls Brazilian industry has blossomed into technological self-sufficiency: most of the technology now used in Brazilian industry is of domestic origin and design. In the AMI industry, Brazilian domestic manufacturers produce and design as much as 80 per cent of the technology used to manufacture agricultural machinery and implements. Some commentators claim that this 80 per cent technological self-sufficiency could not have been possible without a comprehensive system of import controls.

Other Latin American countries have tried the Brazilian policy of import controls: Argentina, Chile, Mexico, Peru and Venezuela have all tried to emulate the Brazilian system of import controls with adaptations to their particular needs. However, most of these attempts at curbing imports have not generally been successful. There have been many reasons offered to explain this but the most common explanations are: constant changes in policy, import controls that have been piecemeal rather than general, and widespread corruption. Argentina and Mexico are often given as examples where constant changes in policy, piecemeal rather than general import controls, and a corrupt administrative system have led only to a relatively small decrease in imports. In Argentina, continous policy changes have led to great uncertainty; as a result, investment has been frozen and development retarded. Mexico has suffered greatly from corruption in the administration of its import control system not surprisingly, this system has had limited success.

33/ It should be remembered that the various estimated elasticities of substitution were derived from a two-stage CES (Constant Elasticity of Substitution) production function. The estimated elasticities are therefore trustworthy only if the regressions estimated in the two stage estimation procedure are correctly specified.

34/ World Bank, World Development Report 1986, op.cit., pp. 95-101 and H. Binswanger and G. Donovan, op. cit.

35/ The following discussion of the effects of Brazil's system of import controls is based on Trading in Latin America: The Impact of Changing Policies, op. cit.

The Brazilian import controls have been successful in that they have not forced firms to close or decrease production because they cannot compete with foreign products, as was the case in Chile, Uruguay and especially Argentina. They have, however, resulted in lay-offs and the cessation of uneconomic product lines.

Companies have reacted to Brazil's tight import controls by finding local supply sources; most firms have been successful in doing this. While the process of finding alternative local suppliers is working, it is costly and can take a considerable amount of time. Firms who have found ways to reduce imports and increase exports are rewarded by Cacex by being given a special "guia", which is valid for one year and states what products were being imported and in what quantities. This special guia system allows firms to by-pass much of the bureaucracy involved in making import applications. The special guia system appears to have worked well.

On the other hand, the Brazilian import control system has had some unfortunate side-effects. For one thing, it made it difficult to bring in needed raw materials. It has led to a large amount of paperwork for firms, and the long delays before permission to import goods is granted has sometimes resulted in production bottlenecks and increased costs of production.

In addition it has also been argued that Brazil's system of import controls and other protectionist measures have been biased against manufactured exports, which would include AMI.[36/] This bias against exports is because import controls have made the domestic market relatively more attractive, and also because there has been an implicit policy of only allowing exports when the domestic market has been satisfied. In retrospect, this implicit bias against exports may have been sensible during the period following World War II to the 1970s since during this period domestic demand was the major force behind manufacturing growth. However this policy is less credible now for two reasons. First, Brazilian manufacturing industry - which includes the AMI industry - is well passed the infant stage of development which might warrant some protection from foreign competition. Second, the recent slump in the world prices of Brazil's major primary product exports - coffee, soybeans, and sugar - means that Brazil must concentrate on exporting more manufactured products to obtain needed foreign exchange and improve its external debt position. AMI could play a major role in this regard. For further growth, Brazil's manufacturing sector and AMI industry in particular must branch out into export markets. This requires some restructuring and liberalization of Brazil's system of import controls and other protectionist measures.

36/ W. Tyler finds ("The Anti-Export Bias in Brazil", Weltwirtschaftliches Archiv, Volume 119, No. 1-2, 1983, pp 97-108; see also UNIDO, "Industrial Development Review: Brazil", Regional and Country Studies Branch, Chapter 2, forthcoming 1987) in contrasting the relative attractiveness of the domestic versus the export market in 1977, based on an evaluation of nominal protection and export subsidy rates, that in 51 out of 58 branches of Brazilian industry there was anti-export bias in that protectionist policies made the domestic market more attractive than exports aided by subsidies.

At present foreign markets appear to be of little importance to the Brazilian AMI industry. In 1981, for example, the share of exports as a percentage of the total sales of AMI, in terms of units sold, was under 6 per cent. This is because, under the protection of import controls, the AMI industry has produced mainly for the home market. It is difficult to assess whether the small share of exports in total sales is also due to the fact that Brazil's export incentive schemes have been ineffective for AMI producers. However the available evidence from the 1970s about Brazil export incentive schemes in general does not seem to support the position that the growth of manufacturing exports was mainly caused by subsidies. Though these export incentive policies were important in that they were a counter to the export bias of Brazil's protectionist policies, the growth in manufactured exports seems to have reflected other factors: demand increases due to increased income, the liberalization of international trade, the increased competitiveness of Brazilian industry due to its maturation under the policy of import substitution, and the successful exploitation of Brazil's comparative advantage in traditional industries.[37/]

(c) The effects of Brazil's personal income tax exemptions

The aim of personal income tax exemptions for rural producers is to encourage the acquisition of AMI. Unfortunately, it is doubtful whether these exemptions have had the intended effect. This is because, under normal conditions, rural producers pay such an insignificant amount of income tax there may be little additional incentive to buy certain machines and implements as a result of these exemptions.

3.4 Future needs of the AMI industry and future action towards the industry by national, regional and international bodies

3.4.1 Future needs of, and national action towards, the AMI industry

The Brazilian AMI industry is in need of assistance to:

- Remove its obstacles to production: lack of coherent agricultural and livestock production policy, lack of co-ordination of the policies directed towards the industry, lack of adequate levels of foreign exchange, uncertainties caused by frequent changes in agricultural and national economic policies, inefficiencies in product engineering and rural credit schemes, and restrictive tariffs and protective arrangements;

- Improve the performance of institutional mechanisms to foster the development of the industry;

- Elaborate policies and programmes to act as a catalyst for the further development of the industry, and especially to alleviate regional imbalances in the growth of the industry.

37/ "Industrial Development Review: Brazil", op.cit.

The Brazilian Government can only go some way by itself to meet the three major needs of the AMI industry mentioned above. Effective long-term assistance to the industry requires help from regional bodies and international agencies.

In the short-term the Government can take concrete steps to assist the industry by intensifying its efforts to provide a stable economic and political environment conducive to future development. The control of inflation and relaxation of foreign exchange constraints will be crucial in this regard. The Government, in conjunction with industry, can also redouble its efforts to build institutional mechanisms to foster the development of the AMI industry. Effort is especially required to strengthen Brazil's National System of Metrology, Standardization and Industrial Quality (SINMETRO) to facilitate the transfer of technology, to effect modernization, rationalization, import substitution and to improve industrial productivity.

A related need of the industry to that of improvement in standardization and quality control is to develop a national institutional framework to give up-to-date technical information to Brazilian AMI companies and research institutions. The Government can assist the industry by helping manufacturing enterprises to master the technology with which to improve the design and manufacturing quality of Brazilian-made AMI and thereby make them more competitive in world markets. This sort of assistance is especially important for small-to-medium sized firms.

In addition, the Government and the AMI industry should also intensify their efforts to use Brazil's recent experiences in the field of AMI to initiate and/or strengthen co-operate programmes with other developing countries, especially in Latin America. These co-operative efforts can take many forms: joint production ventures, technical know-how and training, help to design and maintain quality standards and so on.

National action is required to restructure Brazil's rural credit schemes for the purchase of AMI. Rural producers, especially smaller producers, still generally experience difficulties in obtaining the finance to acquire needed equipment. This is despite a variety of credit schemes for the purchase of AMI.

National action is also needed to improve Brazil's capability in product engineering, to increase the amount of available foreign exchange, and to elaborate and implement policies and programmes to develop the industry in a more regionally balanced manner. However, national action to meet the above-mentioned needs of the industry is probably most effective if taken with appropriate international technical assistance from regional bodies and international agencies.

3.4.2 Future action towards the industry by national, regional and international bodies[38/]

In Latin America, Brazil is the leading producer of manufactured products in general and AMI in particular. It has a vast industrial potential. Unfortunately, the current foreign exchange crisis it faces could be a serious impediment to the future development of the manufacturing industry as a whole and especially for the AMI industry. Multi-lateral technical assistance, and in particular technical assistance from international agencies such as UNIDO, could play an important part in helping to alleviate the foreign exchange constraints of Brazilian AMI manufacturers. In this regard, UNIDO for example, could act as a co-ordinating body to facilitate negotiations concerning AMI co-operative ventures between Brazil's public and private sector institutions and similar institutions in other countries in Latin America and the developing world. These negotiations could bring together various parties interested in joint ventures and/or co-operative projects which might stimulate further growth in the AMI industry. UNIDO's various specialist branches - Economic Co-operation for Developing Countries, Investment Promotion and Technology, for example - could play pivotal roles to encourage such South-South co-operation.

There is some evidence that Brazil's system of import controls and other protectionist measures, although beneficial in the 1960s and 1970s, are now retarding the growth of its manufacturing industry, which includes the AMI industry.[39/] Some restructuring, therefore, of Brazil's system of protectionist measures - taxes, tariffs and subsidies - would also foster the development of the industry. Although this is primarily a domestic matter, some international agencies - UNCTAD, the World Bank in particular - have relevant expertize in this area and, if necessary, could be called on for technical assistance.

During the latter part of the 1970s and 1980s, Brazil has been extremely successful in counter-trades with African countries. These arrangements have generally involved the exchange of Brazilian manufactured goods for African primary products. International agencies such as UNIDO and regional bodies could play a pivotal role by providing technical assistance to assess the costs and benefits of such arrangements which involve the exchange of Brazilian AMI. In the same context, UNIDO among others, could explore the possibilities of greater South-South co-operation in a more formal institutional framework. Similarly, UNIDO could assist Brazil in developing co-operative arrangements such as multinational production enterprises in the field of AMI.

38/ The discussion in this section is based on UNIDO, "New Concepts and Approaches for Co-operation in Industrial Development", WG. NC/Note 5, 22 April 1987 and, "Industrial Development Review: Brazil", op.cit., section 3.5.

39/ See especially, S. Teitel and F.E. Thoumi, op.cit., pp 455-490.

"Multinational production enterprises are undertakings essentially confined to equity arrangements among two or more developing countries or their nationals to increase their industrial manufacturing output and/or encouraging national resources development through a process of mutual and concerted actions for creation, expansion and/or better utilization of their production potentials as well as fostering their intra-trade flows and bargaining position in the world market. They should guarantee reciprocal benefits from economies of scale, specialization and resource complementarities."[40/]

Because of the complexities involved, multinational production enterprises would have to be considered extremely carefully. If, after due consideration they are deemed to be mutually beneficial, preparatory could be instigated immediately but the actual establishment of multinational production enterprises would take considerably more time. UNIDO has developed guidelines to facilitate such ventures.[41/]

Multinational production enterprises are a specific form of economic and technical co-operation among developing countries (ECDC/TCDC). The Second General Conference of UNIDO, held at Lima, Peru, in March 1975 stressed the need for greater ECDC/TCDC among developing countries and called on the international community to redouble its efforts to help developing countries gain a larger share of world industrial output by greater South-South co-operation. The Caracas Plan of Action which was adopted by the High-Level Conference on Economic Co-operation among Developing Countries, held at Caracas, Venezuela, 13 to 19 May 1981, reaffirmed the recommendations contained in the Buenos Aires Plan of Action for promoting and carrying out TCDC. It also recommended that support to ECDC/TCDC projects should pay particular attention to the utilization of technology, skills and resources available in developing countries.

UNIDO, in conjunction with the Brazilian authorities, should explore other innovative means of ECDC/TCDC to foster the development of the agricultural machinery industry in Brazil. One potentially fruitful form of ECDC/TCDC is the Round-Table Ministerial Meeting on AMI. These types of meetings aim to assist developing countries to develop their AMI industries and ultimately to expand their production of food by promoting long-term co-operative arrangements among developing countries. At these meetings, participants:

- Exchange experience and information on the current situation and trends of the AMI industry in their countries;
- Discuss specific AMI co-operation projects and how they might successfully be implemented by matching specific needs with existing capabilities;

40/ UNIDO/PC.133, "Expert Group Meeting on the Establishment of Multinational Production Enterprises in Developing Countries", 13 February 1986.

41/ Ibid.

- Initiate a dialogue and identify areas for further co-operation.

UNIDO, in conjunction with the Government of Argentina, has recently organized a Round-Table Ministerial Meeting on co-operation among a selected group of developing countries, which included Brazil, in the field of AMI. The meeting was held in Buenos Aires, Argentina, from 3 to 7 November 1986. The meeting identified approximately 90 projects in the area of AMI for implementation by the participants of the meeting in the near future. A significant number of these projects involve Brazilian AMI producers.

UNIDO could also assist Brazil develop its National System of Metrology, Standardization and Industrial Quality (SINMETRO). In this connection, UNIDO could offer technical assistance projects which followed the institution building (capacity/capability building) approach of UNIDO/UNDP. Such projects could establish a lasting capability in the SINMETRO system to plan, promote and co-ordinate the installation of quality management and quality assurance standards in the Brazilian AMI industry.[42/] Unfortunately, the development of the SINMETRO system to its full potential is a long-term task. In the short-term, UNIDO could offer technical assistance to plan, design and implement piolot/demonstration AMI programmes involving metrology, standardization and industrial quality.

Technical assistance from UNIDO and/or other international agencies and regional bodies would also be valuable in helping Brazil to improve its product engineering capability in the production of AMI.

Technical assistance is again required to help Brazil relocate or restructure the production of AMI from the prosperous South to the Depressed North East region of the country. Although this is a difficult undertaking, UNIDO could make a start by encouraging projects which stimulate the growth of regionally dispersed small-to-medium scale production of AMI. This could also be accomplished by encouraging more subcontracting of work for the production of AMI to small-to-medium sized firms over a wider area. However, it cannot be emphasized enough that any technical assistance to help Brazil relocate the production of AMI to the depressed North East region of the country is unlikely to be successful if it simply relocates production facilities but at the same time ignores the relocation of associated infrastructure, industries, and supporting institutions such as R&D institutes, universities and other training facilities and services.

Technical assistance is required to help Brazil restructure its rural credit schemes for the purchase of AMI. This could be done by designing credit schemes which subsidized credit institutions instead of farmers to encourage them to take the greater risks of lending to small farmers. In addition, this would give credit institutions an incentive to consider borrowers and investment opportunities who hitherto have been overlooked.[43/]

42/ For an assessment of Brazil's system of metrology, standardization and industrial quality, see - UNIDO, "Metrology, Standardization and Industrial Quality Phase I and II", DP/ID/SER, C/12, 18 February 1987.

43/ See, World Bank, World Development Report 1986, op.cit., pp. 98-99.

In addition, technical assistance would be useful in increasing the transfer of technology - especially microelectronics and Flexible Automation Technologies (FMS) - to facilitate the production of improved, cost-effective, high-quality AMI products in Brazil. An important part of this form of technical assistance would be help to enable Brazil to turn its experience with AMI to greater commercial profitability by developing expert systems for the repair and maintenance of AMI products.

Expert systems are computer programmes which "apply the processes of logical reasoning to a body of knowledge and stores them as a 'knowledge base' in a computer".[44/] Brazil now has developed its own quite sophisticated computer industry and with appropriate technical assistance it could develop AMI expert systems for export.[45/]

Finally, UNIDO could assist Brazil to pair sister enterprises producing AMI in Brazil and in other developing countries, especially in Latin America. Usually the sister enterprise approach involves matching small enterprises in a developed and developing country with the support of official bilateral agreements. A sister enterprise strategy could act as a catalyst for the future growth of Brazil's AMI industry. UNIDO could assist Brazil in further exploring the possibilities of such ventures and also in matching Brazilian AMI producers with others in developing countries.

3.5 Conclusions, recommendations and areas for possible technical assistance

3.5.1 Conclusions

Brazil has the most diversified and technologically advanced AMI industry in Latin America and one of the most advanced industries in the developing world. Brazilian-made AMI products range from the most simple agricultural implements to advanced powered machinery and tractors. Despite enjoying sustained growth in the 1960s and 1970s, the industry has suffered a recent recession due to:

- The lack of a coherent agricultural and livestock production policy;[46/]
- The lack of co-ordination in the policies directed towards the industry;[47/]

44/ "New Concepts and Approaches for Co-operation in Industrial Development", op. cit. p.12.

45/ See, P.B. Evans, "State, Capital, and the Transformation of Dependence: The Brazilian Computer Case", World Development, Vol. 14, No. 7 1986, pp. 791-808.

46/ "Brazilian National Paper on Agricultural Machinery", op. cit.

47/ Ibid.

- The uncertainty caused by frequent changes in agricultural and national economic policies;[48/]
- The inefficiencies of rural credit schemes for the purchase of AMI;[49/]
- Inefficiencies in product engineering;[50/]
- Foreign exchange constraints;[51/]
- Restrictive tariff and protective measures;[52/]
- The fact that Brazil's National System of Metrology, Standardization and Industrial Quality (SINMETRO) is still in the early stages of development.[53/]

Brazil now possesses the experience and much of the technical know-how and institutional mechanisms to develop an extremely successful AMI industry. If the problems referred to above are addressed in an appropriate manner, the potential for growth in Brazil's AMI industry is enormous, especially at the international level.

3.5.2 Recommendations and suggested areas for technical assistance

(a) Brazilian Government

The Brazilian Government, in consultation with private industry, farmers and other groups and institutions concerned with AMI may wish to:

- Strengthen their efforts to provide a stable economic and political environment conducive to the further development of the AMI industry;
- Intensify their efforts to develop Brazil's National System of Metrology, Standardization and Industrial Quality (SINMETRO);
- Address the weakness of the Brazilian AMI industry in product engineering;

48/ "Brazilian National Paper on Agricultural Machinery", op.cit.

49/ Ibid.

50/ "The Multipurpose Approach to Agricultural Machinery Manufacturing in Latin America", op.cit.

51/ "Industrial Development Review: Brazil", and Teitel and Thoumi, op.cit.

52/ Ibid.

53/ "Metrology, Standardization and Industrial Quality Phase I and II", op.cit.

- Restructure Brazil's system of tariffs, taxes, subsidies and other protective measures;

- Seek international technical assistance to:

  (i) Establish counter-trades and Multinational Production Enterprises;
  (ii) Initiate suitable projects to improve industrial productivity and quality;
  (iii) Develop subcontracting arrangements for small-to-medium scale enterprises to correct regional imbalances in the production of AMI;
  (iv) Develop expert systems for the repair and maintenance of AMI;
  (v) Match AMI producing sister enterprises in Brazil with those in other developing countries;
  (vi) Restructure Brazil's rural credit schemes for the purchase of AMI.

(b) Regional bodies and international agencies

Regional bodies, UNIDO and other international agencies should consider the provision of appropriate technical assistance to:

- Restructure Brazil's rural credit schemes for the purchase of AMI;

- Assess the costs and benefits of counter-trades to the AMI industry, especially with African countries;

- Explore the possibilities of more extensive and innovative South-South co-operation in AMI such as counter-trades and multinational production enterprises in a more routinized institutional framework;

- Strengthen Brazil's National System of Metrology, Standardization and Industrial Quality (SINMETRO) to improve the productivity of Brazil's AMI industry and the quality of its products; and, help to plan, design and implement pilot/demonstration programmes in this area;

- Encourage the growth of regionally dispersed small-to-medium scale production of AMI and, associated infrastructure, industries and supporting institutions to redress the regional imbalances in the industry;

- Increase the transfer of technology to improve the design and manufacture of Brazil's AMI.

- Develop expert systems for the repair and maintenance of AMI for possible export to other developing countries.

- Pair sister AMI producing enterprises in Brazil with those in other developing countries - especially in Latin America - to act as a catalyst for the further development of Brazil's AMI industry.

4. THE DEVELOPMENT OF THE AGRICULTURAL MACHINERY AND IMPLEMENTS INDUSTRY IN VENEZUELA

4.1 The evolution of the agricultural machinery and implements industry

The agricultural machinery and implements industry in Venezuela developed as in many other Latin American countries from workshops which produced hand tools and some simple implements and machinery. The development of the industry in its modern form - that is, manufacturing equipment, machinery and hand tools - dates primarily from the 1960s. The first tractor factories were established as branches or subsidiaries of transnational corporations such as John Deere, Deutz and Ford. At present, the industry is suffering from the current economic crisis the country faces along with many other Latin American countries.[54/] In order to overcome the economic crisis, the Government has taken a number of steps which should especially benefit the AMI industry.

In this regard, within the guidelines elaborated in the Seventh National Development Plan, agriculture is given high priority. The Plan notes "an unsuitable relationship between the production and the consumption of agricultural products" as well as a marked deterioration in living conditions in rural areas.[55/] For this reason, the Government has proposed that an action programme be carried out aimed at the "Full Consolidation of Agriculture as a Priority Economic Activity".[56/] The Government argues that it is only by giving agriculture this prominent place that it can be made dynamic and capable of contributing significantly to the nation's food supplies, to the creation of employment, and to an improvement in the living conditions of the rural population.

In addition, the authorities hope that the high priority given to agriculture will help to modify substantially the existing structure of agriculture and lead to increased output and productivity of certain items of mass consumption for which production on a national scale is essential. It is hoped that the rational use of modern techniques and technologies can contribute to the achievement of these proposed objectives. The country is therefore turning towards the practical introduction of a modern form of agriculture in which a very important role will be played by the use of agricultural machinery and implements.

Venezuela's general strategy for the development of the capital goods industry, of which the agricultural machinery industry is a part, is to try to link better those industrial complexes which produce most of the equipment

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54/ This study draws on the "Venezuelan National Paper on Agricultural Machinery", "Politicas Nacionales, Regionales E Internacionales Para Fomen Tar El Desarrollo De La Industria De La Maquinaria En America Latina," presented by Mr. Gustavo Adolfo Martinez, Director, Division of Agricultural Planning, CORDIPLAN, Venezuela at the UNIDO-INTI Ministerial Roundtable on Agricultural Machinery held at Buenos Aires, Argentina, 2-7 November 1986. The Venezuelan national paper was prepared in accordance with guidelines elaborated by UNIDO's Sectoral Studies Branch.

55/ Ibid., p.1.

56/ Ibid., p.1.

used in the various sectors of industry. To utilize Venezuela's comparative advantage, this calls for the establishment of multi-purpose production plants which are a complex of fully-integrated and complementary plants.

4.2 Present structure of the Venezuelan agricultural machinery and implements (AMI) industry

The AMI industry in Venezuela is mainly in the hands of the private sector. The state limits its role in the industry to that of a supervisor. However, in the past, the state has exercised some control over imports, production, prices, distribution and the utilization of raw materials.

Imports consist mainly of agricultural tractors and harvestors. The AMI industry in Venezuela is engaged mainly in assembling machinery and tools. Many of the parts assembled are imported.

Pulled equipment and hydraulic, complex mechanical tools (excluding tractors) are produced by the larger enterprises in the country. Small-to-medium-scale enterprises produce animal drawn equipment and manual tools.

At the present time, the available industrial facilities for the production and assembly of AMI consist of 20 medium-scale and small-scale enterprises. In addition, there are a larger number of enterprises devoted to the production of agricultural implements and the manufacture of tanks, silos, drinking troughs and other items. These enterprises are to be found throughout the country, but there is a marked tendency for the larger undertakings to be established near the major urban centres.

4.2.1 The size distribution of farms in Venezuela

The size distribution of farms in Venezuela is as follows: small farms - up to 10 hectares - 30 per cent; small to medium farms - from 10 to 200 hectares - 35 per cent; medium-sized farms - 201 to 500 hectares - 20 per cent; medium to large farms - 501 to 5,000 hectares - 10 per cent; and very large farms - more than 5,000 hectares - 5 per cent. Thus the majority of farms are of less than 200 hectares.

4.2.2 Types of agricultural machinery used in Venezuela

Each of the various types of agricultural activity requires appropriate machinery. In each type of agricultural activity the following equipment is most commonly used.

(a) Preparation of land for purposes of levelling, irrigation and drainage. Among the equipment used in deforestation and land-levelling activities are:

- Self-propelled machinery
- Land levellers
- Crawler
- Tractors
- Trailers and surfacers

(b) Preparation of land for sowing. The implements for the work preceding sowing are:

- Wheeled tractors
- Big-romes
- Harrows
- Cultivators
- Rotary hoes

(c) Sowing and fertilization of crops. For placing the seed in the prepared soil, use is made of:

- Seed broadcasters
- Precision seeders
- Fertilizer-application equipment

(d) Crop maintenance. Venezuela uses the following equipment for the control of pests and diseases, weeding and so on:

- Tine cultivators
- Sprinklers of various kinds
- Scythes
- Crop-spraying aircraft
- Irrigation equipment

(e) Harvesting. Machinery and equipment used for the handling and conversion of products are:

- Elevators
- Scratchers
- Threshers
- Mills
- Driers
- Haulage trucks

There are also a variety of traditional manual implements used:

- Machetes
- Picks
- Spades
- "Palines"
- Chícoras (earth-digging tools)
- Rakes
- Weeding hoes
- Wheelbarrows
- Baskets

The use of the various implements mentioned reflects their availability in the country and also permits better efficiency in routine work in the field. Although the implements used are part of a foreign technological package, they suit the different textures of the soil and have increased the technological skills of the workforce.

4.2.3 Domestic production of AMI

Venezuela does not produce tractors but produces a large variety of agricultural machinery and implements. The various types of agricultural machinery produced, include: harrows, rollers, ploughs, hand carts, rotary fertilizer distributors, seed drills, land levellers, cultivators, rotary cultivators, discs for ploughs and harrows, rotary driers, trenching machines, subsoilers, furrow openers and shovels and trailers.

In addition, Venezuela produces tools and implements such as "chicuras", picks, hoes and weeding hoes, shovels and spades, wheelbarrows, hammers, machetes, skids ("patines") and "chicurones", hand carts, rakes, knives, pick axes and adzes.

The country also produces such agricultural equipment as automatic poultry feeders, hanging feed troughs, automatic drinking troughs, fumigators, channel feeders for poultry, manual poultry feeders, starter plates, valves for drinking troughs, plastic drinking troughs, channels for automatic drinking troughs and feeders, and cattle ramps.

The local content of domestically produced products

The percentage local content of products sold in the domestic market varies, but in some cases it reaches as high as 80 per cent. As a result of policies adopted by the Ministry of Development to encourage the incorporation of parts and components of local manufacture, the local content in the manufacture of agricultural machinery and implements had increased considerably. Products with an especially high incorporation of locally made parts and components are: aluminium sheets and sections, grease, nuts and bolts, calibrated steel and other items. Components which are commonly imported are: high-resistance steel bars, stainless steel and manganese steel strip, roller bearings, coulters, ball-bearings, hydraulic jacks, chains, gearboxes and telescopic cardan shafts.

In agricultural tools, the national component consists of nuts and bolts, electrodes, sawn wood and other minor items. In the manufacture of agricultural equipment, there is extensive use of domestically produced galvanized sheets, nuts and bolts, rivets and pulleys, and imported components which include stainless steel strip, automatic water-control valves, conveyor chains, polypropylene and dyes.

4.2.4 Industrial profile

In Venezuela, there is a tendency for production to be concentrated in the larger enterprises. Three enterprises manufacture almost all the agricultural machinery and implements registered as of domestic production. There is also a concomitant tendency to concentrate on smaller items or less significant items in terms of value.

There are not many establishments with a diversified productive base. However, these firms profitably supply domestic needs for items in greatest demand which are capable of being produced nationally.

In Venezuela there are no enterprises which are manufacturers both of capital goods and of agricultural machinery and equipment. Even though the latter are classified as capital goods, they constitute clearly differentiated

subsectors in light of their particular features and problems. On the one hand, there are metal working and engineering facilities devoted to the production of metal structures, valves, boiler-shop products, pumps, tubing, forged products, castings and other items in frequent demand in the petroleum and petrochemical industry, in the electrical sector and in processing industry. On the other hand, there are establishments devoted specifically to the manufacture of machinery, equipment, implements and tools for agricultural use.

In the capital goods sector there is a tendency towards vertical integration. It is for this reason that an attempt has been made to establish a production complex which will make use of the country's installed capacities on a horizontal basis, even though problems in this regard still persist.

In the case of manufacturers of agricultural machinery and equipment, it appears from discussions held with executives and managers of the enterprises that there are very few manufacturing establishments where vertical integration exists.[57/] There is also no significant complementarity between enterprises. This is reflected in a tendency to try to produce only a few items in each shop, resorting to the purchase of materials and inputs offered on the market. There are only a few firms which, having established a plant for the manufacture of discs for the production of their own ploughs and harrows, offer this facility to competing enterprises.

The same discussions have brought to light the fact that many Venezuelan enterprises which manufacture agricultural machinery, equipment and implements resist diversifying by producing parts and components intended for other sectors. This resistance is understandable in as much as the great diversity of types of products and an excessive variety of existing models would require large volumes of materials and inputs. This would make management extremely difficult, as well as causing a substantial increase in stock-handling costs.[58/]

In Venezuela, the multi-purpose approach - which can be suitable for countries which are initiating investment programmes for the establishment of manufacturing plants for capital goods and agricultural machinery - is also adopted in existing industrial establishments which have been in operation for some years.

To be successful, the multi-purpose approach must take into account the economic, social and political realities of the country.[59/] This requires prior or parallel action in the area of standardization and rationalization, aimed at reducing unnecessary variety. The multi-purpose approach may allow advantage such as increased and more effective utilization of installed production capacity and the mastery of diversified production techniques.

Tables 12, 13, 14 and 15 indicate that the agricultural machinery and implements (AMI) industry in Venezuela operates at less than full capacity.

57/ "Venezuelan National Paper on Agricultural Machinery", op.cit., p. 9.

58/ Ibid.

59/ Ibid., p.10. See also for a general assessment of the multi-product approach: UNIDO/IS.607, "The Multipurpose Approach to Agricultural Machinery Manufacture in Latin America", Sectoral Studies Working Paper Series No. 46, 12 February 1986.

It appears that domestic installed capacity is sufficient to cover internal needs in the areas mentioned, with sufficient margin for export.[60] The tables also give the production levels achieved in 1982 and 1983 for farming equipment and tools. In both instances there was sufficient capacity to fulfill internal demand.[61] Domestic demand dropped dramatically in 1982 and 1983 as a result of the stagnation of the country's economy during that biennium.

Since 1984 domestic demand has recovered appreciably due to the economic reactivation policy of the present Government, particularly with regard to the farming sector.

As shown in table 13, the low domestic AMI production rate has also led to a reduced demand for imports. The Venezuelan authorities suggest that this reduced demand for imported machinery and equipment indicates that the country's fixed capital stock is not being replaced as one would expect and that this will have a negative impact on productive capacity in the long term.

It should be stressed that the ongoing expansion of farm output has been based on a process of technological change and modernization through the massive incorporation of new technologies and capital assets. This increase in output has been achieved with a relatively small harvested surface area but double the use of farm tractors, certified seeds, and chemical fertilizers.

The authorities hope that the current Government measures regarding the re-financing of the farm debt, the increase in minimum prices for certain products, the amendment of laws governing financial activity in the agricultural sector, and the special investment plan for the farming sector will prove to be an immediate stimulus for the recovery farm output. To this end, the current (1985-1986) Development Plan intends to expand the boundary of agriculture contemplated by the National Government. Farming will require 3.3 million hectares of which 2.4 million (i.e. 73 per cent of the total requirement) relate to the "annual mechanized crop growing" system. Livestock production will require some 24.0 million hectares, thereby virtually doubling the area currently used.[62] These figures indicate that it is necessary to make a considerable effort to modernize agriculture and livestock breeding. This will imply a significant increase in the current levels of mechanization and as a result, increases in the demand for machinery and equipment for agricultural use, particularly wheeled tractors. The extent of the likely increase in the demand for agricultural machinery and implements can be seen in tables 16-21.

The following tables show the apparent consumption of wheeled and crawler tractors, the number of wheeled tractors, the projected demand for wheeled tractors (two versions), the import of (wheeled) tractor wheels from the United States and the possibilities for national integration or the possibilities for incorporating components made locally.[63]

60/ "Venezuelan National Paper on Agricultural Machinery", op.cit., p.11.

61/ Ibid.

62/ "Venezuelan National Paper on Agricultural Machinery", op.cit., p.16.

63/ Apparent consumption is defined to be domestic production minus imports plus exports.

Table 12. Farming implements and machinery (units)

Product	Installed capacity	Production	
		1982	1983
Semi-heavy harrow	5,390	1,083	488
Hydraulic lifting harrow	1,954	524	430
Argentine roller	313	122	57
Plough	1,549	338	204
Box cart	20	...	10
Rotary fertilizer spreader	150	113	47
Combined seed and fertilizer drill	1,500	741	93
Soil leveller	42	...	21
Cultivator	753	190	233
Rotary cultivator	2	...	1
Plough and harrow discs	80,000	42,210	41,828
Rotary dryer	3,232	1,130	706
"Sanjador" or furrow opener	2	...	1
Subsoil plough	26	...	1
Furrow opener	146	...	70
Spades and trailers	400	...	...

Source: Venezuelan National Paper on Agricultural Machinery (1986), p.12

Table 13. Venezuela: Imports of farming equipment and machinery - 1975-1983

Product	1975	1976	1977	1978	1979	1980	1981	1982
Wheeled tractors (units)	27,966	27,358	39,484	20,105	11,943	11,028	16,966	18,421
				(tons)				
Farming and horticultural machinery, appliances and artifacts for preparation and working the soil and for cultivation.	3,555	2,886	3,694	2,051	4,324	1,604	1,604	1,455
Harvesting and threshing machinery; straw and forage presses, lawnmowers, selection machinery etc.	6,872	3,836	6,557	5,963	5,538	4,546	4,008	3,867
Milking machines and other dairy machinery and appliances.	126	163	248	174	318	569	514	561
Presses, juicers and other equipment used in viniculture, cider making and similar.	14	25	8	7	2	28	3	1
Other machinery and appliances for farming, horticulture, aviculture and apiculture, including germinators, incubators and breeders.	1,895	2,059	2,936	4,656	1,335	2,036	2,362	519
Machinery for milling and for processing cereals and dried vegetable.	3,680	2,332	2,575	1,633	1,449	1,638	1,537	3,813
Machinery and equipment not mentioned or included in other items in the present list for use in the making of bread, biscuits, cakes, food pastes, sugar products, beer, meats, fish vegetables and fruit.	7,985	7,204	10,158	8,983	4,299	6,530	9,179	5,352

Source: Venezuelan National Paper on Agricultural Machinery (1986), p.13.

Table 14. Farming implements (units)

Product	Installed capacity	Production 1982	Production 1983
"Chicura" earth digging tools	360,000	32,228	36,540
Picks and spades	512,500	158,183	145,057
Weeding hoes and mattocks	1,043,500	235,219	173,324
Spades and shovels	500,000	48,884	83,976
Wheelbarrows	25,000	5,250	8,388
Hammers	1,177,000	194,561	168,173
Machetes	1,000,000	134,615	186,945
"Palines" and "Chicurones"	250,000	13,350	51,600
Box carts	600	200	100
Rakes	100,000	3,071	10,020
Knives	10,000	...	3,000
Pickaxes	225,000	54,300	161,873
Adzes	63,000	41,226	12,258

Source: Venezuelan National Paper on Agricultural Machinery (1986), p.14.

Table 15. Farming equipment (units)

Product	Installed capacity	Production 1982	Production 1983
Automatic bird feeders	2,000	211	181
Hanging feeders	120,000	35,912	18,400
Automatic drink dispensers	217,000	83,100	49,436
Fumigators	6,500	1,255	795
Channel feeders for birds	19,000	4,000	2,700
Manual feeders for birds	125,000	78,300	58,000
Starting plate	35,000	...	...
Valves for drink dispensers	22,000	7,645	7,424
Plastic drink dispensers	155,000	17,200	16,596
Channels for automatic feeders	55,000	11,768	4,890
Channels for automatic drink dispensers	26,000	592	6,837
Cattle ramps	150	41	64

Source: Venezuelan National Paper on Agricultural Machinery (1986), p.15.

Table 16. Venezuela: Apparent consumption of wheeled tractors - 1975-1984

Year	Weight (thousand of kg)	Value (thousand of Bs)	Units
1975	27,965	311,157	5,179
1976	27,358	320,486	5,066
1977	39,384	501,321	7,293
1978	20,105	294,100	3,723
1979	11,943	179,499	2,112
1980	11,028	193,475	2,042
1981	16,966	316,705	3,142
1982	18,421	367,178	3,411
1983	3,357	75,740	622
1984	6,084	175,504	1,127

Sources: Foreign Trade Institute and calculations of the Division of Agricultural Planning, CORDIPLAN, cited in Venezuelan national Paper on Agricultural Machinery (1986), P.18.

Table 17. Venezuela: Apparent comsumption of crawler tractors - 1975-1984

Year	Weight (thousands of kg)	Value (thousands of Bs)	Units
1975	19,260	164,252	494
1976	17,637	144,170	452
1977	17,461	179,034	448
1978	7,838	86,215	201
1979	2,717	27,350	70
1980	2,650	31,626	68
1981	5,262	64,452	145
1982	5,807	86,500	148
1983	1,705	60,385	44
1984	2,144	37,125	55

Sources: Foreign Trade Institute and calculations of the Division of Agricultural Planning, CORDIPLAN, cited in Venezuelan National Paper on Agricultural Machinery (1986), p.19.

Table 18. Numbers of wheeled tractors (units)

Year	Imports	1980	1981	1982	1983	1984
1961	683	34	...	...	...	...
1962	1,908	153	95	...	...	...
1963	1,540	158	123	77	...	...
1964	2,039	274	209	163	102	...
1965	3,038	516	408	311	243	152
1966	1,678	361	285	226	172	134
1967	1,479	385	318	251	199	152
1968	1,983	615	516	426	337	267
1969	2,338	865	725	608	503	397
1970	2,692	1,144	996	835	700	579
1971	3,406	1,703	1,448	1,260	1,056	886
1972	3,502	1,996	1,751	1,488	1,296	1,086
1973	2,143	1,382	1,222	1,072	911	793
1974	2,737	1,957	1,765	1,560	1,369	1,163
1975	5,179	4,066	3,703	3,340	2,952	2,590
1976	5,066	4,281	3,977	3,622	3,268	2,888
1977	7,293	6,600	6,163	5,725	5,214	4,704
1978	3,723	3,518	3,369	3,146	2,923	2,662
1979	2,112	2,070	1,996	1,911	1,785	1,658
1980	2,042	2,032	2,001	1,930	1,848	1,725
1981	3,142	...	3,126	3,079	2,969	2,844
1982	3,411	...	...	3,394	3,343	3,223
1983	622	...	...	...	619	610
1984	1,127	...	...	...	...	1,121

Sources: Venezuelan Foreign Trade Bulletins, Ministry of Agriculture and Livestock Annual Statistical Reports, Ministry of Development Automotive Sector Figures and Projections, and calculations of the Division of Agricultural Planning, CORDIPLAN, cited in Venezuelan National Paper on Agricultural Machinery (1986), p.20.

Table 19. Projected demand for wheeled tractors - 1985-1989

Year	A Area harvested (hectares)	B No. of tractors (units)	Degree of mechanization (A/B)	Tractor demand
1980	1,731,083	34,109	50.75	...
1981	1,674,525	34,196	48.97	...
1982	1,685,072	34,425	48.95	...
1983	1,589,907	31,807	49.99	...
1984	1,594,768	29,632	53.82	...
1985	1,658,559	30,817	53.82	3,962
1986	1,724,901	32,050	53.82	4,120
1987	1,793,897	33,332	53.82	4,285
1988	1,865,653	34,665	53.82	4,456
1989	1,940,279	36,052	53.82	4,635

Source: Calculations of the Division of Agricultural Planning, cited in Venezuelan National Paper on Agricultural Machinery (1986), p.22.

Table 20. (Wheeled) tractor wheel imports from United States of America (units)

Power (HP)	1978	1979	1980	1981	1982	Total	Distribution (percentage)
Less than 40	65	56	117	198	14	450	9.69
From 40 to 60	...	12	...	39	11	62	1.34
From 60 to 80	75	...	...	10	95	180	3.88
From 80 to 100	200	81	41	58	10	390	8.40
From 100 to 120	255	196	218	252	142	1,063	22.89
From 120 to 140	355	133	210	236	136	1,070	23.05
From 140 to 160	356	32	91	83	26	588	12.66
From 160 to 180	5	22	21	57	12	117	2.52
Over 180	37	28	54	32	1	152	3.27
Not specified	159	145	102	57	108	571	12.30

Note: Imports for 1983 and 1984 not included because they are negligible.

Source: Venezuelan National Paper on Agricultural Machinery (1986), p.23.

Table 21. Wheeled tractors, breakdown of parts, possible national integration (percentage)

Description	Value	Possible incorporation
Bonnet	0.833	0.730
Rear mudguard assembly	1.576	1.576
Seat assembly	1.045	1.045
Bodywork box	0.409	0.409
Frame	1.163	1.163
Steering system	2.180	2.180
Front suspension	4.306	3.200
Front axle assembly	3.327	1.667
Differential and locking assembly	2.327	0.539
Rear axle assembly	6.787	...
Brake pedal assembly	0.639	0.639
Drum brake assembly	2.020	1.515
Hand brake assembly	0.448	0.448
Engine	23.486	2.118
Air filter	0.479	0.479
Acceleration system	0.197	0.197
Cooling system	1.057	1.057
Exhaust system	0.463	0.463
Fuel system	0.522	0.204
Battery	0.987	0.987
Horn	0.044	0.044
Harnesses	0.229	0.229
Starter cable	0.052	0.052
Other parts of the electrical system	0.194	...
Instrument panel	0.566	...
Headlight assembly	0.447	0.032
Clutch assembly	2.507	...
Clutch pedal assembly	0.343	0.343
Gears	6.478	...
Gearbox	8.140	...
Gear change	2.111	...
Power takeoff control assembly	0.303	...
Transmission brake	0.023	...
Power takeoff shaft assembly	1.188	...
Tires	8.027	8.027
Wheels	1.929	1.929
Paintwork	0.767	0.767
Fluids	0.023	...
Semi-solids	0.959	...
Coupling	1.056	...
Hydraulic system	5.441	...
Tools	0.129	...
Hydraulic pump assembly	...	...
Ventilation system	...	...

Source: Venezuelan National Paper on Agricultural Machinery (1986), p.24.

4.2.5 Obstacles to production

One of the major obstacles to the production of AMI in Venezuela is its inadequate road system. Roads are often of poor quality, non-existent or where good roads are available, they are limited to certain areas. The development of the AMI industry is not helped either by the fact that the country has too few available means of transport and inadequate infrastructure. Irrigation and drainage systems, and silos are especially deficient in coverage and quality.

Government experts also point out that somewhat paradoxically, in the past, Venezuela's favourable exchange rate with respect to the major international currencies has been a major obstacle to the development of an indigenous AMI industry. A favourable exchange rate made it cheap to import agricultural machinery and implements. This led to a number of difficulties: a dependency on foreign technology that was not suited to Venezuela's agro-ecological conditions, and an inertia in developing and designing needed machinery, tools and supporting infrastructure.

The AMI industry also experiences great difficulty in obtaining a local supply of essential raw materials. These difficulties have, at times, been exacerbated by the fact that the pertinent authorities have delayed decisions concerning raw materials, especially which relate to the granting of preferential currency for buying certain raw materials - for example, certain types of steel - that are not available in the country. In addition, the marketing and storage of agricultural products is often inadequate.

At present, there does not exist an adequate national institutional mechanism to help the AMI producers select and adapt appropriate technology to Venezuelan conditions. This is one area where the country especially requests qualified expertise and other forms of technical assistance. The non-existence of a regular and comprehensive national source on AMI products and processes; the lack of regular supplies of raw materials, finance and skilled labour are further barriers to the development of a local AMI industry. Furthermore, there is little national institutional support given to farmers or workers in production units for training in the use of machinery and its maintenance.

4.3 Policies and programmes directed towards the AMI industry

4.3.1 Institutional mechanism to foster the development of AMI

Until as recent as 1984 there has been no institutional mechanism to co-ordinate the development of the AMI industry. The AMI industry was the responsibility of many government departments who dealt with the industry on an ad hoc basis. This situation changed with the establishment of the National Commission on the Mechanization of Agriculture. This body advises the Government on all matters relating to national policies for the mechanization of agriculture.

The individual institutional authorities responsible for particular facets of the development of the industry are as follows:

- The Ministry for Agriculture and Animal Husbandry;
- The Office for Differential Exchange Rates of the Ministry of Finance;
- The Ministry for Public Works and Agriculture

The Ministry for Public Works and Agriculture deals with matters concerned with the creation of enterprises to produce AMI. The Ministry of Agriculture and Animal Husbandry is responsible for assessing the utilization and handling of agricultural machinery and equipment. The Office for Differential Exchange Rates of the Ministry of Finance deals with the availability of foreign exchange for industry.

There are also smaller, more specialized government bodies who deal with specific aspects connected with the production and development of AMI:

- CORPOINDUSTRIA, grants loans for the development of small-to-medium scale industry;
- FONCRET is responsible for loans to larger enterprises;
- CORDIPLAN approves development plans.

In addition to the government bodies mentioned above there are numerous private financial institutions which provide loans for the purchase and maintenance of machinery.

Venezuela also has various institutional mechanisms for selecting and/or adapting technology so that it is appropriate for local conditions. The Ministry of Environment together with more specialized agencies FONAIAP and PRODETEC carry out detailed studies of soil conditions. The Ministry of Agriculture and Animal Husbandry advises on the machinery appropriate for specific tasks. The Ministry of Public Works grants import licenses for AMI. The work of these government bodies is meant to ensure the AMI produced or imported into the country is suitable for Venezuela's specific needs. In practice, however, as mentioned earlier, AMI producers still experience difficulties in obtaining help to select and adapt appropriate technology to Venezuelan conditions.

There is no separate body at the national level solely responsible for reseach and development of AMI. However, the Ministry of Public Works does give support to establish new AMI enterprises, as well as anything to do with research, commercialization and production of spare parts. Although there is no specific local contents law, the utilization of locally produced components is encouraged by the Ministry of Public Works through the Programme for the Incorporation of Local Spare parts. This programme is implemented by the Sectoral Department for Industries of the Ministry of Public Works.

4.3.2 Existing policies and programmes directed towards the AMI industry

In Venezuela a number of measures are being taken which are helping greatly to strengthen the agricultural machinery and implements industry. These measures also serve to increase the Venezuelan share in the industry and to expand the industry.

Some of the more important of these measures include tariff protection under the Andean Pact, VAN export incentives amounting to some 70 per cent, the Incorporation of Domestic Spare Parts and Components Programme and various other related policies and programmes implemented by the Ministry of Development.

Policies related to the AMI industry are drawn up and carried out by the various ministries described earlier. They cover mainly matters connected with the import, manufacture, distribution and methods of use of machinery and implements. The previously mentioned official bodies have the purpose of regulating relationships between manufacturers and assemblers, importers, suppliers and users, according to the requirements determined by the annual agricultural development plans.

Venezuela's main strategy is to progressively reduce dependence on foreign suppliers of agricultural machinery and implements and encourage domestic production. To this end, the metallurgical engineering industry is being encouraged to develop agricultural machinery and implements, with financing of domestic production on the basis of medium to large-sized enterprises or plants, and limitation of imports according to annual demand for AMI.

The national policies which have been applied in the last few years to develop the agricultural sector (1984-1986) constitute the main factor providing a stimulus to and encouraging the development of Venezuela's agricultural machinery industry.

The rapid increase in the area sown annually has caused an extraordinary demand for agricultural machinery and implements. It is estimated that during the period referred to, the area under cultivation will have increased by 500,000 hectares, the principal crops sown being cereals: maize, sorghum and rice. The general aim is to achieve, under the present Government, national self-sufficiency in the major agricultural products and raw materials.[64/]

4.4 Future needs of the agricultural machinery and implements industry and action that might be taken at the national, regional and international levels to help the industry

4.4.1 Future needs of the industry

According to Venezuelan experts, future measures to be taken towards the AMI industry should be directed towards the encouragement of greater production and diversification of the country's agricultural machinery and implements industry. This will reduce external dependence by giving domestic producers a greater share of the market. Incentives to encourage the production of AMI should be directed at the private sector; the State's role continuing to be one of providing guidance and regulation. In preparation for these future measures institutional support and co-ordination has been strengthened through the recent establishment of the National Commission on the Mechanization of Agriculture.

The change in the external value of Venezuela's currency has made imports expensive and highlighted the need for local manufacture of the equipment and machinery needed within the country. This means improving the existing infrastructure and creating new infrastructures. It will also be necessary to provide appropriate training of personnel in order to achieve increased domestic production and meet the present demand for AMI.

64/ "Venezuelan National Paper on Agricultural Machinery", op.cit., p.26.

Venezuela's strategy for the development of the AMI industry is to progressively reduce external technological dependence and stimulate domestic industry. To this end the development of the metallurgical engineering industry in the agricultural machinery and implements sector is being encouraged, as well as the financing of domestic production based on medium-sized enterprises or plants, with limited imports.

The domestic policies applied in the last few years (1984-1986) by the Government are a major factor encouraging the promotion and development of the industry. These policies have resulted in an increase in the area under cultivation and induced a greater demand for agricultural machinery. It is estimated that the increase in the area under cultivation has been on the order of 500,000 hectares, mainly sown with cereals: maize, sorghum and rice.[65/] The aim is to achieve domestic self-sufficiency in the major agricultural products and raw materials.

By adopting a multi-purpose approach involving the establishment and integration of a complex of industries, products and processes, Venezuela aims to develop a capital goods industry. There is a clear need for integrated industrial complexes for the production of the equipment used in certain sectors: rolling stock, agricultural machinery and equipment, the electrical sector, the oil sector, the processing industries and instrumentation and electronics.

In the specific case of agricultural machinery, despite some uncertainty as to whether the existing firms producing agricultural implements can diversify their production, it nevertheless appears possible to envisage multi-purpose plants for the manufacture of new implements used in agriculture.

The Venezuelan National Council for the Development of the Capital Goods Industry considers it essential to make detailed studies in order to determine the possibilities of manufacturing agricultural machinery and implements suited to Venezuela's soil characteristics, climate, crops, dietary habits, and so on. In this connection, contacts have been made with members of the Faculty of Agronomy of the Central University of Venezuela. The Agronomy Faculty has shown interest in carrying out studies to determine the feasibility of manufacturing in Venezuela prototypes of agricultual machinery that are not currently produced elsewhere, not even in the highly developed countries that have traditionally exported these goods to Venezuela but which have not always suited its needs.

The multi-purpose approach will also be explored more fully. The multi-production concept is by no means unknown in Venezuela.[66/] There already exist manufacturing units which operate successfully as multi-purpose manufacturing plants.

65/ "Venezuelan National Paper on Agricultural Machinery", op.cit., p.28.

66/ See Carlos Enrique Vargas Arenas, "Algunas Consideraciones sobre la Industria de Maquinaria Agricola Y Bienes de Capital, Y el Concepto de Multiproduccion en Venezuela," 1986.

The National Council for the Development of the Capital Goods Industry, with technical assistance from UNIDO, has made progress in the formulation of a development strategy aimed at the establishment of a capital goods and services production complex based on the specialization and complementarity of enterprises.

The idea is to have a complex and multi-purpose plant. It is proposed to establish a consolidated industrial infrastructure (iron and steel, aluminium, forging and smelting) to supply the needs of the various sectors.

Venezuela possesses a number of industrial plants in these areas of production which, if properly used, would ensure an excellent chance for the successful implementation of the multi-purpose approach. It possesses a broad range of mineral and energy resources that have made possible the establishment of integrated and semi-integrated iron and steel complexes which supply a number of manufacturers in the metallurgical engineering sector in general and the capital goods sector in particular.

4.4.2 Future action towards the industry by national, regional and international bodies

There are a number of steps that could be taken at the national, regional and international levels to aid the development of the Venezuelan AMI industry. Basically, these steps consist of short and medium-to-long term policies and concrete programmes of action to remove existing obstacles to production. These steps should be taken by the appropriate national bodies with material support and advice from the relevant regional and international bodies. The specific form of support by the regional and international bodies will depend on the specific obstacle to production that is confronted.

In the short term, there is a need for financing for the promotion of new industries, training of staff for the production, handling and maintenance of machinery, linking of sectors, and enterprises which produce capital goods. There is also a need for detailed information to users on products available and laws regulating imports and giving incentives to exporters.

In the medium term, there is need for concrete programmes of action to expand the market for AMI and the supply of spare parts for AMI, and to improve the quality and coverage of roads. In the long term, efforts must be made to develop R&D into AMI at the national level and to turn this work into commercial profitability; resources must be available to produce people with more sophisticated knowledge of the production, use and maintenance of AMI.

4.5 Conclusions and areas for possible technical assistance

4.5.1 Conclusions

(a) The policy which is being pursued in Venezuela in the capital goods sector aims at establishing an integrated industrial complex of which the main feature is specialization of production and complementarity between enterprises. Plants with diversified production nevertheless form part of this complex.

(b) As the country is well provided with raw material and energy resources and its industrial plants function well, Venezuela has excellent possibilities of developing such multi-purpose enterprises for the production of goods and services.

(c) The agricultural machinery and equipment manufacturing industry has sufficient installed capacity to satisfy domestic demand in those sectors where local production exists at present. It is necessary, however, to intensify efforts to achieve a greater degree of complementarity and co-operation between enterprises and with other sectors.

(d) A study is being made in Venezuela of the feasibility of commencing production of new agricultural equipment and implements suitable for the conditions of a tropical country as regards to soils, climate, crops and dietary habits.[67/] Such production could be undertaken on the basis of plants with diversified manufacturing processes, making use, as appropriate, of the experience of other developing countries.

(e) There is a need for more intensive work in the field of standardization and rationalization of production. This will call for a reduction of the unnecessarily broad range of products in the subsector of agricultural machinery and equipment and in other capital goods subsectors.

(f) With regard to the manufacture of wheeled tractors, it is clear that the domestic demand scarcely justifies such production. Also, effort should be made to standardize and reduce inventory costs.

4.5.2 Technical assistance

Venezuela has need of technical assistance in a number of areas:

(a) The development and production of machinery and equipment for:

- Deforestation and utilization of land;
- The harvesting, conservation and conditioning, handling and transporation of agricultural products.

(b) The local production of tractors and spare parts which are currently imported, especially where there is a suitable local supply of raw materials that could be used to produce these goods.

(c) Research into and the production of machinery appropriate for local conditions.

(d) Training in the use and maintenance of AMI. This is the area in which Venezuela has the greatest need for technical assistance.

67/ "Venezuelan National Paper on Agricultural Machinery", op.cit., p. 13.

5. THE DEVELOPMENT OF THE AGRICULTURAL MACHINERY AND IMPLEMENTS INDUSTRY IN GUATEMALA[68/]

5.1 The evolution of the agricultural machinery and implements industry

Agriculture accounts for more than one fourth of GDP in Guatemala and absorbs more than half of the economically active labour force. Exports of agricultural produce - in particular coffee and cotton - amount to three quarters of Guatemala's total exports.

However, the degree of agricultural mechanization, as can be seen in table 22, is very small considering the country's total area of arable land is approximately 1,850,000 hectares and that it has roughly 40,000 rural properties.

Table 22. Guatemala: Agricultural machinery and implements in operation - 1979

Item	Units	Number of farms	Proportion on total farms a/
Ploughs (animal)	28,757	19,916	52.9
Ploughs (tractor)	4,863	2,816	7.5
Mechanical cultivators	3,082	1,619	4.3
Harrows	5,020	2,586	6.9
Planters	1,905	1,064	2.8
Harvesters	345	227	6.0
Threshers	489	345	9.2
Corn shellers	1,389	1,265	3.4
Sprayer pumps	36,654	17,883	47.5
Tractors	8,931	3,420	9.1
Trucks	2,848	4,557	12.1
Jeeps and pick-ups	6,238	1,948	5.2
Trailers	13,966	4,173	23.6
Irrigation pumps	3,862	2,274	6.0
Stationary motors (diesel)	5,938	3,532	9.4
Stationary motors (electric)	3,376	904	2.4

a/ Total farms: 37,674.

Source: Censo Agropecuário, 1979.

68/ This study draws on the "Guatemalan National Paper on the Agricultural Machinery and Implements Industry", "Breves apuntes sobre política industrial con énfasis en la industria de maquinaria agrícola", presented by Ing. Agr. Oscar Rolando Castillo, Deputy Director General, Agricultural Services (DIGES), Guatemala at the UNIDO-INTI Ministerial Roundtable on Agricultural Machinery held at Buenos Aires, Argentina, 2-7 November 1986. The Guatemalan National Paper was prepared in accordance with guidelines elaborated by UNIDO's Sectoral Studies Branch.

Most of the agricultural machinery and implements used in Guatemala are imported, since there is no agricultural machinery industry per se in Guatemala. However, there is some small scale domestic production of agricultural machinery and implements (mainly implements), but this is generally carried by various enterprises which produce capital goods and not by enterprises specializing in the production of agricultural machinery.

In recent years, the consumption of agricultural machinery and implements has declined largely due to a continuous decrease in agricultural output. In 1981, agricultural output only grew by 1.7 per cent. In 1982, agricultural output actually decreased by 2 per cent and even further to 2.5 in 1983.

Due to a drop in international prices in 1980, the cotton sub-sector - the largest consumer of machinery, tractors, ploughs, harrows and cultivators - reduced its planted area by roughly one third. This has led to a large fall in the demand for agricultural machinery and implements. Revenues from coffee, which represents about 30 per cent of Guatemala's total exports, have also declined precipitously as a result of the fall in the world price of coffee. Although the output of coffee is not highly mechanized in Guatemala, the reduction in its output has also greatly affected the demand for agricultural machinery and implements.

The market for agricultural machinery has also been seriously affected by the current recession in the country.

The future development of an agricultural machinery and implements industry in Guatemala, therefore, depends crucially on a revival of the country's economy, particularly the manufacturing and agricultural sectors. Thus, an examination of the structure and recent economic performance of Guatemala's economy and agricultural sector provides an essential background for an assessment of the prospects for the future development of an agricultural machinery industry in Guatemala. We begin with an examination of Guatemala's recent economic performance.

5.2 Structure and performance of the Guatemalan economy and agricultural sector

5.2.1 Recent economic trends[69/]

In 1960, Guatemala joined the other countries of Central America to form the Central American Common Market (C.A.C.M). The aim of the CACM was to promote the industrialization of the region. Membership of the CACM coupled with conservative monetary and fiscal policies gave the country nearly two decades of sustained economic growth.[70/] Between 1960-1980, the average annual percentage growth of GDP was 5 per cent, inflation was kept, on average, to 1 per cent per annum and the average growth rate of real GDP per capita was 2.7 per cent per annum.

Since the late 1970s, however, the Guatemalan economy has been seriously affected by a ten-fold increase in oil prices and the global recession. The

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69/ This section is based on UNIDO, "Industrial Development Review: Guatemala", Regional and Country Studies Branch, draft 1986.

70/ For details, see "Industrial Development Review: Guatemala" op.cit., Chapter 2.

economy has experienced severe imbalances in the balance of payments, and during the period 1978 to 1981 especially, growing fiscal deficits. This combination of factors has led to a deep economic recession. The economic recession has been particularly harmful to the productive sectors of the economy - especially manufacturing and commerce. The average annual percentage growth rate of GDP has fallen almost every year since 1981. During 1981-1985, the fall in GDP's average annual percentage rate was 2 per cent. During the same period, the average annual percentage growth rate of real GDP per capita was minus 4.7 per cent and unemployment grew to reach an estimated 41.7 per cent of the economically active population in 1984.

The recession in Guatemala has also been fuelled by the country's large fiscal deficits and the external debts of the public sector.

Public sector deficits have grown annually despite deep cuts in public investment, in particular infrastructure projects. Tax revenues, one of the lowest in the world as a percentage of GNP, fell from 7.6 per cent of GDP in 1981 to 5.3 per cent in 1984. The country's total external debt trebled from $US 820 million in 1980 to $US 2,456 million in 1984.

Since 1981 Guatemala's trade with other CACM countries, which accounts for nearly 30 per cent of the country's total exports of merchandise, has declined steadily. This has been due to a number of reasons. There has been an economic recession which has befallen most Central American countries. Guatemala has experienced bilateral trade problems with some members of the CACM community. The country has also experienced considerable difficulty in settling intra-CACM balance of payments accounts in hard currency. Since nearly 90 per cent of CACM trade is in manufactures, it is not surprising that Guatemala's manufacturing sector has been most affected by the country's trading difficulties with the CACM.

The reduction in CACM trade has also meant a reduction in the availability of foreign exchange. This has led to reduced imports of essential raw materials and capital goods to the further detriment of manufacturing which is heavily dependent on imports.

In response to the recession, since 1981 the Government has instigated various economic measures to stabilize the economy. These measures have led to a severe contraction in domestic demand and a fall in capital investment and exports.

5.2.2 The structure of Guatemala's agricultural system

The development of a country's agricultural machinery and implements industry reflects to a large extent the stage of development and structure of its agriculture. Thus, an examination of the development of a country's agriculture often reveals the potential for the development of an indigenous AMI industry.

Guatemala is predominantly an agricultural economy even though it is one of the most industrialized countries in Central America. Between 1970-1984, exports of primary products accounted for over 75 per cent of export revenues. During the same period, agriculture's share of GDP was on average 26.5 per cent and approximately 55 per cent of the economically active population was employed in agriculture. Approximately 10 per cent of the total area of land in Guatemala is arable land. In 1983, for example, out of

a total land area of 10.9 million hectares, Guatemala had only 1.3 million hectares of arable land and of this land, 0.48 million hectares were devoted to permanent crops and 1.33 hectares to permanent pastures.

In recent years there have been strong moves to diversify Guatemala's agriculture to increase the output and variety of export crops. For example, ANACAFE, the national coffee association, has made efforts, within its diversification programme, to encourage coffee growers to move away from coffee to produce palm oil which is a major cash crop.

In addition, since 1984 there have been a SIECA - Secretaría Permanente del Tratado General de Integración Económica Centroamericana (Permanent Secretariat for Economic Integration in Central America) - programme to help CACM countries diversify agricultural exports from dependence on a few cash crops whose prices are invariably falling on international markets. The programme has three objectives. The first objective is to meet the demand for basic foods in neighbouring countries - in particular Mexico and Venezuela - by exporting corn, beans and rice to these countries. The second objective of the programme is to achieve an integrated agricultural production programme in CACM countries through which member countries can pool their resources to increase productivity in staple foods. The third objective of the programme is to harmonize the variety of crops grown in order to build-up stocks of agricultural products from the output of all CACM countries. It is hoped that, as a result of this programme, CACM agricultural products will become more competitive in world markets. It is also hoped that the prices of agricultural inputs - seeds, chemicals and farming equipment - will fall for CACM members if these inputs are the subject of joint negotiation through the CACM rather than individual members acting independently. SIECA estimates that the potential market for foodstuffs in the CACM may be as much as $US 5 billion a year.

Until 1983, Guatemala, in common with other countries in Central America (C.A.), devoted an increasing proportion of its arable land to export crops to the detriment of food crops. In 1970, for Central America as a whole, only 16 per cent of the total cultivated land was used for food crops. By contrast, over 50 per cent of land was used for export crops.[71/] The percentage of cultivated land devoted to food crops in Guatemala in 1970 (25.3 per cent) exceeded the regional average of 16 per cent. However, the total area devoted to export crops and grazing was approximately 50 per cent (export crops 10.9 per cent, grazing 29.8 per cent). [72/] This concentration on the production of export crops can be seen more clearly if we look at the percentage of land used for the five major export crops - cotton, coffee, sugar, bananas and sorghum - compared to that for the three staple food crops - corn, beans and rice. During 1965-1970 in Central America out of a total harvested area of 3367 thousand hectares, 59.7 per cent of the land was used for basic foods and 40.3 per cent was devoted to export crops. Between 1975-1979, however, these figures were 52.2 per cent for basic foods and 47.8 per cent for export exports. Thus in CA as a whole between 1975-1979 compared to 1965-1970 the total area harvested for export crops grew at the expense of foods crops.

71/ See John Weeks, The Economies of Central America, New York, Holmes and Meir, (1986) and Nola Reinhardt, "Agro-Exports and the Peasantry in the Agrian Reforms of El Salvador and Nicaragua", World Development, Volume 15, No. 7, pp. 941-959, (July 1987).

72/ John Weeks, op.cit.

The data for Guatemala show a similar tendency. During 1965-1970, out of a total harvested area of 1,242 thousand hectares, 67.3 per cent of the land was used for basic foods and 32.7 per cent was used for exports. Between 1975-1979, out of a total area of 1156 hectares, only 57.6 per cent of the land was used for basic foods and 42.4 per cent for export crops. Thus the data for Guatemala between 1975-1979 compared to 1965-1970 also shows that during this period an increasing percentage of land was devoted to export crops at the expense of food crops.[73/] The figures for the production of food and export crops in the 1970s compared to the 1960s also illustrate a similar phenomenum.

Table 23. Percentage change in production of major food and export crops, annual averages 1960s to 1970s (1960-1969 compared to 1970-1979)

Basic Foods	Costa Rica	El Salvador	Guatemala[a/]	Honduras	Nicaragua[b/]	Central America
Corn	1.0	77.8	24.8	14.5	17.4	28.9
Beans	-31.3	105.6	16.0	10.6	-2.7	14.9
Rice	90.2	32.0	60.6	108.4	60.6	72.3
Export crops						
Sorghum	152.1	53.4	97.0	17.6	14.5	47.1
Sugar	64.2	105.6	105.8	78.3	93.8	91.9
Cotton	-59.4	27.6	66.7	-33.8	60.9	48.9
Bananas	142.3	- [c/]	98.4	44.5	822.1	84.9
Coffee	27.4	19.8	38.0	155.0	54.1	38.0
Population growth	25.0	30.0	32.0	35.0	34.0	31.0

a/ Through crop year 1977/1978.
b/ Last crop year of decade omitted because of effects of war.
c/ El Salvador has negligible banana production.

Source: John Weeks, The Economies of Central America, Holmes and Meier (1986), p.105.

Table 23 shows the percentage change in the production of major food and export crops (annual averages) in Central America. The table compares the situation in the 1960s to the 1970s (specifically 1960-1969 compared to 1970-1979). The table clearly shows that what held true for Central America was also so for Guatemala: compared to the 1960s in the 1970s, the output of basic foods increased but these increases were dwarfted, in percentage terms, by increases in the output of export crops. However, since the early 1980s, the authorities in Guatemala have made strong attempts to re-establish the ascendancy of the country's traditional food crops in agricultural output. The Government has encouraged this shift back to traditional food crops by

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73/ John Weeks, op.cit., pp. 101-104.

manipulating agricultural support prices. The recent fall in the world prices of Guatemala's cash crop has also led to a shift from cash crops to basic staples, particularly grains and pulses.[74/]

5.2.3 Main types, sizes and ownership patterns of farms in Guatemala

Along with the tendency in Central America to concentrate on agroexports there has also been a concomitant increase in the percentage of landless rural families. In 1970, for Central America as a whole, over one-quarter of the total number of rural families were landless. As can be seen from table 24, (a) and (b), of the rural families that had some land, approximately 17 per cent had less than 0.7 hectares and 50 per cent had four hectares or less. The corresponding figures for Guatemala are even more striking: 15 per cent of families had less than 0.7 hectares and 57 per cent had four hectares or less. Thus in Guatemala, 1970 data shows that a significant percentage of rural families were landless and that the majority of rural families were in the minifundia range, cultivating less than four hectares of land. Commonly in Central America, farms with less than four hectares are too small for self-sufficiency and their owners must find alternative paid labour to augment their incomes.[75/] In Guatemala there is also an almost "virtual absence of the 'middle peasant'; i.e., the peasant with enough land to be self-sufficient".[76/]

Table 24. Distribution of rural families and agricultural land by size of holding - 1970

(a) Percentage distribution of rural families

Size of holding	Costa Rica	El Salvador	Guatemala	Honduras	Nicaragua	Central America
(Hectares)						
Landless	26.3	26.1	26.6	31.4	33.8	28.1
Less than 0.7	32.2	24.4	15.0	10.3	1.5	16.8
0.7-4	13.1	36.2	42.3	24.1	24.2	32.6
4-7	13.1	36.2	42.3	24.1	24.2	32.6
7-35	14.6	4.9	7.4	18.1	18.1	10.7
35-350	8.3	2.0	1.4	3.9	13.5	4.0
more than 350	0.7	0.2	0.4	0.3	1.0	0.4
Total	100.0	100.0	100.0	100.0	100.0	100.0
Landless or insufficient land	--	86.7	83.9	65.8	59.5	--

Note: Landless or insufficient land is defined as farms with less than four hectares. Generally, four hectares or less are too small for self-sufficiency, and the families occupying these farms must obtain part-time paid employment to augment their incomes.

74/ "Industrial Development Review: Guatemala", op.cit., p. 6.

75/ John Weeks, op.cit., p. 114.

76/ Ibid., p. 113.

(b) Percentage distribution of agricultural land

Size of holding	Costa Rica	El Salvador	Guatemala	Honduras	Nicaragua	Central America
(Hectares)						
Less than 0.7	0.3	1.3	1.0	0.8	-	0.6
0.7-4	1.5	12.3	11.3	5.5	1.6	6.0
4-7	1.5	5.2	6.3	6.1	1.8	4.0
7-35	14.3	16.7	15.1	27.4	11.3	16.2
35-350	41.1	33.6	23.9	32.7	44.1	35.2
more than 350	41.3	30.9	42.4	27.5	41.2	38.0
	100.0	100.0	100.0	100.0	100.0	100.0

Note: - indicates less than 0.1 per cent.

Source: John Weeks, The Economies of Central America, Holmes and Meier (1986), p.112.

In the Central American context it is thought that a self-sufficient "middle peasant" would include those rural families who own farms of between four and thirty-five hectares.[77/] Table 25 shows that in Guatemala only 14 per cent of farms fall into this size range in 1970. From parts (a) and (b) of table 24 it can also be seen that in Guatemala roughly 2 per cent of rural families own approximately 65 per cent of farm land. Part (b) of table 24 also shows that in Guatemala 84 per cent of rural families hold 19 per cent of the land. This data illustrates the high concentration of land ownership in the hands of a few. Other data indicates that this concentration of land ownership was much greater in the 1970s than it was in the 1950s.

Table 25 gives the distribution of families by size of holding in Guatemala in 1950, 1964 and 1979. In 1950, 48 per cent of rural families had holdings of less than two "manzanas"; in 1964 this figure fell to 44 per cent; in 1979 it rose to 60 per cent. The percentage of agricultural families holding less than one "manzana" (0.7 hectares) of land in 1964 compared to 1979 tells a similar story. In 1964, 20 per cent of rural families had less than one manzana of land; in 1979, this figure had risen to 41 per cent.[78/]

77/ John Weeks, op.cit., p. 115.

78/ This increase could be explained by increased population growth, but the rural population also experienced population growth between 1950 and 1964 when the percentage of families with less than one manzana actually declined, albeit slightly. John Weeks, op.cit., p. 117.

Table 25. Guatemala: Distribution of families by size of holding - 1950, 1964 and 1979.

Size of holding (Manzanas)	Distribution of families 1950 Per cent	1964 Per cent	1979 Per cent
Less than 1	21.3	20.4	41.1
1-2	26.3	23.6	19.4
2-5	28.6	30.9	20.8
5-10	12.2	12.5	8.4
10-32	7.7	8.9	6.6
32-64	1.8	1.6	1.5
64 and more	2.1	2.1	2.2
Total	100.0	100.0	100.0

Note: The rather odd last three size categories result from the use in the surveys of the archaic measure cabelleria, which in Guatemala is about 64 manzanas or 43 hectares (which differs from the unit of measures of the same name in Cuba and Puerto Rico).

Source: John Weeks, The Economies of Central America, Holmes and Meier (1986), p. 116.

5.2.4 Recent economic performance of the agricultural sector

Agricultural output, as measured by the index of agricultural production, has decreased since 1981. Available statistics show that the index of agricultural output, using 1975 as the base year, increased by a little more than 18 per cent to 118.4 in 1981, fell by approximately 6 per cent to 111.7 in 1983 amd recovered slightly by roughly 2 per cent to reach 113.9 in 1984.

Guatemala has traditionally depended on five exports - coffee, sugar, cotton, bananas and meat. However, the importance of these traditional exports have declined in recent years. For example, in 1978 these five traditional agricultural exports accounted for 67 per cent of the country's total exports of merchandise, but in 1984 this figure dropped to 52 per cent. Revenues from agricultural exports have been used to support the exapansion of the manufacturing sector, particularly food processing, beverages, tobacco, textiles, wood and paper. Since 1980, revenues from Guatemala's traditional export crops have declined. This decline in revenues has created a growing demand for working capital credits. Unfortunately the commercial banking system has been unable to extend any new loans to agriculture because of the difficulty many farmers have had in coming up with collateral guarantees in the current situation of depressed prices for their products.

5.3 Domestic production of agricultural machinery and implements[79/]

There is no agricultural machinery industry per se in Guatemala. However, agricultural machinery and implements (mainly implements) are made by various enterprises which produce capital goods. In 1983, capital goods amounted to 6.5 per cent of Guatemala's total industrial output, or in constant value terms, (1958 Quetzales) 73,485.8 thousand Quetzales. Of the production of capital goods, which includes agricultural machinery and implements, metallic products (excluding machinery and equipment for transport) comprised 52.6 per cent and machinery construction, not including electrical machinery amounted to 1.1 per cent of total output. Thus the production of machinery including agricultural machinery comprised an extremely small percentage of the output of capital goods in 1983.

At present, most of the capital goods industry produces agricultural tools and implements such as machetes and large hoes. In fact in Central America only El Salvador produces more AMI. In 1979 the value of Guatemala's output of AMI was $US 3.3 million; this sum was 3.57 times more than in 1970. The production of machetes comprises 66 per cent of Guatemala's total output of AMI. Next in importance in the production of AMI in Guatemala are big hoes. The production of machetes and big hoes have an important role in Guatemala's agriculture. This is because unlike the larger countries in Latin America who have almost completely mechanised their agricultural operations and at the same time have to use scarce and highly paid skilled labour, Guatemala has relatively large reserves of cheap and unskilled labour. This unskilled labour can be economically used with hand tools such as machetes and big hoes, especially in the more hilly regions where powered equipment cannot be utilized efficiently.

In addition to machetes and big hoes, Guatemala also produces threshers for maize, straw cutters, threshing machines, manual sprayers, wooden and iron ploughs, harrows, sowers, hammer mills, choppers and grinders, farm wagons, coffee processing machines, manual drills, winnowers, and ox-drawn carts. Most of these products are manufactured in small workshops but unfortunately little capital is invested in these workshops.

Although there are many types of products produced within each product group, individual products are essentially of the same basic design and are generally of poor quality.

With the notable exceptions of machetes and big hoes, almost all of the domestically produced AMI are for the local market.

Although Guatemala produces a wide range of machinery and implements, this is done on a very small scale and always manufactured to order. For example, two typical firms, included in a 1981 census survey, employed altogether 63 people and produced 15 harrows, 5 hullers, 87 winnowers and 3 threshers. These firms do, however, receive orders from other sectors as well.

79/ The following discussion is based on material presented in the Guatemalan national paper on agricultural machinery and UNIDO/IS.607, "The Multipurpose Approach to Agricultural Machinery Manufacturing in Latin America," Sectoral Working Paper Series No. 46, Sectoral Studies Branch, Division for Industrial Studies, 12 February 1986.

There are only a few manufacturers of agricultural machinery and implements. These are mostly small workshops and several of them are located in rural areas. The following are among the most import:

- COLLINS: manufactures hand tools, especially matchetes
- RESORTES QUICHE: manufactures animal drawn implements and parts
- TALLERES FUENTES HNOS: manufactures agricultural machinery in general
- MAQUINARIA AGROINDUSTRIAL S.A: manufactures, among other things, ploughs, cultivators, weeders, planters, fertilizers, fumigators and trailers.
- AARCO: manufacture, among other things, harrows, trailers and cultivators.
- MAQUINARIA TOPKI: mainly distributor and manufacturer of irrigation systems equipment.

All these industries, with the exception of COLLINS, are made up entirely of Guatemalan capital and do not use foreign licenses.

Another firm, EMASA, which produced implements for soil preparation and cultivation was operating until a few years ago. This company closed down due to marketing and management problems and its assets were sold to AARCO.

AARCO is the most modern firm with good prospects. Its principal characteristics are:

- It is divided into two branches: a traditional metallic frameworks division, established in 1962, and a new agro-industrial division, created in 1984.
- Its capital is entirely Guatemalan.
- Production is diversified in the agro-industrial division: harrows, trailers, cultivators, hammer mills, choppers and grinders, and so on.
- It makes its own models - that is, copies or adaptations of designs from other manufacturers.
- It does repair work, maintenance and produces spare parts.
- The industrial process includes all stages, with the exception of foundry, as it can avail itself of the entire line of the metallic framework division.
- The target for production is to reach a total revenue of $US 1.5 million in five years by exporting to Central America and the Caribbean.

5.3.1 Imports

The imports of agricultural machinery, implements and tools underwent a continuous decline in the period 1977-1983, falling from $US 31.7 million to $US 6.2 million. In 1984, however, a significant reversal of this trend was observed, where imports increased by almost 60 per cent (tables 26 and 27).

The reduction in imports was mainly due to tractors, the share of which dropped from 62.6 per cent in 1977 to 28.1 per cent in 1983.

Imports of agricultural machinery and implements (except tractors and tools), also fell continuously in the period under consideration, decreasing in value from $US 11 million in 1977, to $US 3.5 million in 1983.

Table 26. Guatemala: Composition of imports - 1977-1984

Year	Tools	Machinery and implements	Tractors	Total	($US thousand)
1977	2.6	34.8	62.6	100.0	31,725
1978	5.6	33.3	61.1	100.0	27,157
1979	6.6	41.5	51.9	100.0	20,449
1980	7.2	33.9	58.9	100.0	17,859
1981	8.0	38.1	53.9	100.0	15,570
1982	20.0	42.0	38.0	100.0	8,434
1983	15.5	56.4	28.1	100.0	6,155
1984	14.1	48.7	37.2	100.0	9,086

Source: Banco de Guatemala.

The most important agricultural machinery and implements imports, in terms of value, are: item 712-02-01 - mechanical mowers, harvesters, threshers, balers; item 712-02-02 - cornshellers, huskers, sugar cane and rice machinery, fibre shredders, coffee mills; and, item 712-02-03 - grain, fruit pickers and classifiers (table 27).

In 1984, the following countries were the most significant suppliers of AMI imports to Guatemala:

- Hand tools: El Salvador (61 per cent), Brazil (11 per cent);
- Machinery for soil preparation: the United States (32 per cent), Japan (25 per cent), Italy (18 per cent);
- Mechanical mowers. threshers. harvesters: The United States (71 per cent), United Kingdom (27 per cent);
- Cornshellers, huskers, etc.: the United States (34 per cent), Brazil (27 per cent), El Salvador (13 per cent);
- Grain, fruit pickers and classifiers: the United States (79 per cent);
- Tractors: the United States (57 per cent), Mexico (16 per cent), Spain (10 per cent).

5.3.2 Exports

Foreign sales of agricultural machinery and implements showed a continuous growth during the period 1970-1978, rising from $US 624,000 in 1970 to twice as much in 1978.

The majority of Guatemala's exports were machetes which represented 95 per cent of the total value of exports. In 1981 exports reached a peak and, at the same time, showed a change in profile: foreign sales of machetes decreased drastically, whereas some relevant exports of mechanical equipment for the preparation, cultivation and preparation of the soil and some other items increased (table 28).

Table 28. Guatemala: Imports of agricultural machinery, implements, tools and tractors - 1977-1984
($US thousand CIF)

Nauca Classification	PRODUCTS	1977	1978	1979	1980	1981	1982	1983	1984
	Agricultural Tools.								
699-12-01		836	1,509	1,358	1,291	1,240	1,689	955	1,384
	Agricultural Machinery & Implements	11,038	9,031	8,478	6,062	5,939	3,542	3,473	4,773
712-01-01	Plows	635	662	392	263	130	93	114	139
712-01-02	Cultivators	495	490	446	127	168	4	38	16
712-01-03	Harrows	1,625	1,468	583	402	155	65	16	42
712-01-04	Planters	185	290	194	112	128	359	227	198
712-01-05	Other mechanical machinery for the preparation and cultivation of land N.E.C.	450	607	442	251	292	139	273	162
712-02-01	Mechanical mowers, harvesters, threshers, balers, etc.	2,528	1,384	1,988	971	1,926	473	664	1,001
712-02-02	Cornshellers, huskers, sugarcane & rice machinery, fiber shredders, coffee mills	2,945	2,268	2,367	1,444	1,071	785	537	1,035
712-02-03	Grain, fruit, egg pickers & classifiers	264	382	384	502	138	188	417	543
712-03-01	Milking machinery	32	39	38	35	32	5	5	7
712-03-02	Dairy decreamers	18	29	51	57	27	13	19	11
712-03-03	Other dairy machinery	102	87	152	111	126	53	19	362
712-09-01	Incubators, Breeders	189	119	212	169	34	17	281	60
712-09-02	Agricultural accessories	5	29	18	21	7	3	2	2
712-09-03-01	Manual grain mills, poultry feeders,etc.	183	173	415	325	447	424	147	425
712-09-03-9	Other machinery and accessories	1,382	1,004	793	1,272	1,258	921	714	770
713-01-00	Tractors and parts	19,851	16,617	10,615	10,506	8,391	3,203	1,727	3,649
	TOTAL	31,725	27,157	20,449	17,859	15,570	8,434	6,155	9,806

Source: Banco de Guatemala.

It is interesting to note that all the major categories of Guatemala's AMI exports increased their market shares in 1984.

Concerning the destination of exports, the main buyer of machetes is Nicaragua (71 per cent), followed by Costa Rica. As for the remaining items, El Salvador and Mexico are the major clients. Thus, Guatemala's exports are destined mainly to neighbouring Central American countries.

Table 28. Guatemala: Exports of agricultural machinery and implements, 1977-1984 ($US thousand)

Nauca Classification		1977	1978	1979	1980	1981	1982	1983	1984
699-12-01	Machetes	914	1,202	1,070		49	8	48	22
712-01-01	Ploughs	1	1	17		32	-	-	18
712-01-02	Cultivators	-	1	1		-	-	-	-
712-01-02	Harrows	-	1	1		26	-	-	-
712-01-04	Planters	-	-	-		-	-	-	3
712-01-05	Other mechanical machinery for the preparation and cultivation of land N.E.C.	14	19	122		810	420	43	61
712-02-01	Mechanical mowers, harvesters, threshers. balers, etc.	-	-	5		307	-	80	2
712-02-02	Cornshellers, huskers, sugarcane and rice machinery, fiber shedders, coffee mills	9	32	28		10	65	127	-
712-02-03	Grain and fruit pickers, egg selectors and classifiers	-	1	-		27	16	4	-
712-03-02	Dairy decreamers	-	-	-		5	-	-	-
712-03-03	Other dairy machinery	-	-	-		-	-	1	-
712-09-03	Manual grain mills and other machinery and acc.	-	-	10		53	25	-	-
	TOTAL	938	1,257	1,254		1,319	534	303	106

Source: Banco de Guatemala.

5.3.3 Distribution channels and financing

The sales of imported agricultural machinery and implements is carried out by representatives of the various brands of tractors manufacturers who are both dealers and importers. Before 1977 there were more than twelve agents but now there are less than half that number.

The Government grants subsidized credit to farmers but this is mainly for buying fertilizers. The maximum amount of financing is about $US 8,400. This amount is insufficient to buy a small tractor (60 HP) with implements, which costs more than $US 13,500. Thus this kind of financing is used only by small farmers for the purchase of minor equipment - for example, a manual or a mechanical chopper (approximately $US 1,000).

The usual procedure to buy machinery is to take advantage of dealers' credit, payable over a period of two or three years, or to get financing from commercial banks.

Machinery and equipment made in Guatemala is traditionally bought for cash.

5.3.4 Industrial profile

Over 65 per cent of Guatemala's industries consist of small scale enterprises. More than 75 per cent of these enterprises are concentrated in the departments of Guatemala and Santa Rosa y Quetzaltenango. About a third of the output of these enterprises consist of food products.

Approximately 70 per cent of Guatemala's manufacturing industry is located in Guatemala City. To encourage the geographical decentralization of industry, the Government, in 1975, created a free trade and industrial zone at Santo Tomás de Castilla. Unfortunately, there has been little response to the Government's attempts at decentralization and the current situation is that few firms have settled in the new free trade and industrial zone.

In 1976, the Government also passed a law to encourage decentralization to cities other than Guatemala City. In addition, regional dispersal of manufacturing has been recurring goal of industrial development plans since 1976. There have also been more recent attempts in the form new industrial incentives laws in 1982 and 1984 to encourage decentralization.

Given the present depressed state of the economy Guatemala has little money to pay for manufactured imports. It is not surprising, therefore, that the country imports relatively little capital good imports.[80/] The low level of imports, and especially capital good imports has had a detrimental effect on industry which requires manufactured imports to produce and maintain existing production facilities. Production in many plants is 50 per cent below capacity and in some cases plants have been forced to shut down.

Guatemala's industrial enterprises suffer from a number of problems. First, they are handicapped by a low growth of output and by offering too narrow a range of products. This is due to the decrease in public, private and foreign investments in industry, a scarcity of skilled labour, the vulnerability of industry to external factors outside its control, the dependency on imported foreign technology, and the difficulties experienced in obtaining finance and essential raw materials.

80/ In 1975, capital good imports amounted to 20.2 per cent of total merchandise imports. Between 1975-1984, the share of capital good imports in total merchandise imports fell drastically to 11.5 per cent.

Second, they suffer from a low level of industrialization. During 1962-1981, industrial output only grew by three per cent, from 13 to 16 per cent. The low growth rate of industrial output reflects to a significant extent the small size of product markets in Central America as a whole and Guatemala in particular. The low level of industrialization means that there are few firms at the national level capable of providing for all the needs of the local market. A notable example of a national firm capable of providing for the needs of the local market is Guatemala tools which is more commonly known by its previous name, Collins' Machetes.

There are many reasons given for Guatemala's low level of industrialization.[81/] First, there is inadequate integration of production between primary and secondary sectors and the industrial sector. This is due mainly to structural problems: scarcity of industries producing intermediate and capital goods and the scarcity of agro-industrial projects.

Second, the growth rate in the demand for industrial products is very low. This is the result of a decrease in the domestic demand for industrial products and a decrease in the external demand for these products because of the collapse of the Central American Common Market (CACM), Guatemala's principal export market.

5.3.5 Obstacles to the production of AMI

As it was previously mentioned Guatemala has no national agricultural machinery and implements industry; AMI are produced mainly by small rural workshops. Collins Machetes and Guatemala Tools and AARCO are the only real national producers of AMI. The reason why there are so few national producers of AMI is that there are severe obstacles to the production of AMI which greatly hinder the development of an indigenous AMI industry.

The obstacles to the production of AMI in Guatemala are the same as those faced by other Central American countries. The major obstacle is the extremely small size of the existing and potential national market. This makes it very difficult for Guatemala enterprises to reap the benefits, in terms of reduced unit costs, of large-scale production. There is also the problem of inadequate marketing of products. In many cases there is simply little or no effort devoted to the marketing of AMI products. This applies especially to the small rural workshops. The reason for this is obvious: in the small rural workshops production is for a known but limited local market so there is no need for local marketing. This implies that the growth of the workshop is limited by the size of the local market.

Producers of AMI often face high prices for raw materials and various other inputs, many of which are imported, that are needed for the production of AMI. In addition, these producers generally have inadequate access to finance or simply cannot get finance with which to develop their enterprises.

81/ See "Guatemalan National Paper on Agricultural Machinery", appendix: "Cooperacion paises en desarrollo en la industria maquinaria agricola". op.cit.

The lack of reasonably priced land on which to build production facilities is another obstacle. Other obstacles to production are those already mentioned in connection with Guatemala's industry in general, namely:

- The low level of industrialization and technical competence of industry;
- The inadequate integration of production between primary and secondary sectors and the industrial sector;
- The low growth in the demand for industrial products.

5.4 Policies and programmes directed towards the development of the AMI industry

5.4.1 Existing policies and programmes directed towards the AMI industry

Guatemala does not have an AMI industry per se and there are no specific policies directed towards the development of and indigenous AMI industry. One reason for this is the belief that agricultural mechanization will cause widespread unemployment. There are, however, policies directed towards fostering economic development and industrialization in general. These policies are discussed in more detail in the next section, here we merely note that present policies to aid industrialization stem from the impetus given to industrialization by the creation of the CACM and from the Central American Agreement on Fiscal Incentives For Industrial Development during 1960-1970. A direct result of this agreement in Guatemala was the creation of Guatemala Tools (or Collins Machetes) to produce machetes. Guatemala Tools was able to develop to its present state as the major national producer of AMI largely because it was exempt from paying taxes of any kind for seven years. This Central American Agreement expired in December 1985 when it was replaced by the New Central American Tariff and Customs System.

The new tariff system has provisions explicitly geared towards the AMI industry. Tariff rates on items connected with the production and use of AMI are as follows:

- Import of raw materials, machetes, hoes and so forth: 5 per cent tariff on value added;
- 20 per cent to protective tariff on imported farming equipment.

There are also two major laws in Guatemala directed to industrialization in general that also benefit producers of AMI. The first law - LEY DE INCENTIVAS A LAS EMPRESAS INDUSTRIALES DE EXPORTACION, Decreto Ley 21-84 - gives incentives to industrial export enterprises by allowing them to import tax free. The second law - LEY DE FOMENTO PARA LA DESCENTRALIZACION INDUSTRIAL Y EMPRESAS ACOGODAS A LOS BENEFICIOS DE LA PEQUENA INDUSTRIA, Decreto Ley 24-79 - is directed towards the promotion of industrial de-centralization and small-scale industry. Under this law greater benefits are given to enterprises the further away they are from the capital.[82/]

It is impossible to assess the effects of these two laws because, as yet, no industries exist to benefit from them.

82/ "Guatemalan National Paper on Agricultural Machinery", op.cit., p. 7.

AMI are also given prominence in Guatemala's overall strategy for industrial development. Guatemala's 1983-86 National Plan For Industrial Development states, with respect to the production of AMI, that priority will be given to "the reactivation of those industries which produce agricultural machinery, with the use of simple technology, both to provide the modern and traditional agricultural sectors as well as those sectors which produce with the aid of simple technology certain types of machinery for farming and industrial activities which produce basic consumption goods for the population".[83/]

5.4.2 National industrial policies that might aid the domestic production of AMI but are not specific to the AMI industry

Guatemala has several national industrialization policies and strategies which might aid the domestic production of AMI but are not specific to the AMI industry. The policies and strategies originate from the National Planning System of Guatemala. This system is led by the National Economic Planning Council (CONAPLAN) which formulates economic and sectoral policies. In addition, the Ministry of Economy administers the legal instruments for industrialization and its executive agencies CORFINA and GUATEXPO. These agencies deal with financing and export incentives and promotion respectively. Since the abolition of GUATEXPRO in 1983, its functions have been taken over by the Ministry of Economy and GUATRADE, a private sector trading company.

The Industrial Development Plan 1976-79 was prepared within the framework of the medium-term National Development Plan 1975-79. Further economic and industrial plans were prepared in 1979-82 and 1983-86. The main aim of the medium and long term industrial development plans was to meet the basic needs, particularly food security, of the Guatemalan people. The austerity measures introduced in particular during 1982-84 to cope with the economic recession, made a necessary but adverse impact on the goals and strategies of the medium-term development plan.

The main goals of the medium-term industrial strategy were:

(a) To make a significant contribution towards achieving the targets and objectives given in the comprehensive national economic development plans, with a production structure in accordance with a proposed "basic needs" model of industrialization.

(b) To encourage the development of industrialization with the following priorities:

- Food industries to the support nutritional standards of the low-income population.
- Textile, clothing, leather and footwear industries with a high percentage of local inputs to support the existing patterns of domestic consumption.
- Building materials and housing for the low-income population.
- Industrial inputs to support agriculture and cattle.

83/ "Guatemalan National Paper on Agricultural Machinery", op.cit., p. 7.

(c) To emphasize the development of small- and medium-scale industries using intermediate and simpler technologies. To achieve this objective the following measures were considered important:

- The development of interdependent industrial groups linking factories producing basic consumer goods and factories providing intermediate and some capital goods for firms producing basic consumer goods;
- To promote industrial decentralization based on a rational industrial relocation, in order to optimize the utilization of natural resources and benefit the most depressed rural areas;
- Gradual elimination of structural employment and underemployment through small-scale and handicraft industries;
- To streamline the manufacturing system in order to increase productivity in accordance with proposed employment targets;
- To support manufacturing industry financially, including a larger use of domestic funds and a more rational use of external funds.

In Guatemala's previous industrial development plans of 1976-1979 and 1979-1982 the public sector took the role as the promoter of development through its executive agencies CORFINA and GUATEXPRO. To counter the deterioration in CACM trade - which encouraged product diversification - and the international economic recession, the previous industrial plans proposed diversification of exports outside CACM, to increase petroleum output and its further processing into petrochemical products, and the establishment of hydroelectric plants to reduce energy imports. Recent development plans have also indicated that factories financed by CORFINA should be organized as industrial co-operatives in order to spread their benefits to the population in general. In addition, recent plans have proposed the reorganization of GUATEXPRO as a supporting organization for financing manufactured exports.

5.4.3 Recent changes in industrial policy

The current Industrial Development Plan 1983-1986 has the following major objectives and strategies:

(a) To assist in achieving the main long-term objective of raising the living standards of the Guatemalan population;

(b) To orientate the structure of manufacturing to satisfy the basic needs of the population with durable and non-durable consumer goods and, simultaneously, to support vertical linkages with those branches of industry furnishing intermediate and capital goods;

(c) To favour the process of industrial decentralization and utilization of natural resources;

(d) To support the development of small- and medium-size industries;

(e) To increase and diversify the range of manufactured exports;

(f) To promote the development of national science and technology and to regulate technology imports, and formulate the First National Science and Technology Plan;

(g) To support the establishment of employment generating factories.

The current plan aims at reactivating manufacturing through the private sector. The public sector is expected to support industry through fiscal incentives and financing. In the cases where CORFINA takes equity participation, care will be taken to encourage the establishment of new factories but without entering into competition with the private sector.

5.4.4 Institutional mechanisms to foster the development of industry[84/]

Guatemala has the following institutions to direct the industrialization of the country:

(a) Public sector organizations

The main public sector institutions involved in fostering industrilization are as follows:

- The National Economic Planning Council (CONAFLAN) formulates economic and sectoral plans and strategies to achieve balanced growth between the various sectors of the economy. This work is carried out by its General Secretariat SEGEPLAN;
- The various bureaus of the Ministry of Economy administer industrial and trade legislation as follows:

  (i) The Industrial Policy Bureau administers the legal regulations that guide the industrialization process, in particular fiscal incentives for industrial development;

  (ii) The Interior and Exterior Trade Bureau administers the marketing of certain products subject to price controls, export and import quotas, the issuing of licences and certificates of origin, and the administration of the draw-back system and other functions previously carried out by GUATEXPRO - the executive agency of the Ministry of Economy formerly responsible for export incentives and promotions;

  (iii) The Economic Integration Bureau deals with problems and restrictions affecting the marketing of Guatemalan commodities and manufactures in the CACM;

  (iv) The General Statistics Bureau gathers, processes and publishes economic and industrial statistics.

- The Bank of Guatemala (BG), was established in 1945 as Guatemala's main bank and fiscal agent responsible for formulating and implementing monetary policy, superivisng the efficient operation of the banking system, and controlling the country's international reserves. The bank manages several special purpose funds such as those guaranteeing loans to small enterprises, export credit lines extended by foreign lenders. It also manages the issuing of public bonds to control and channel foreign currency into the country;

84/ This section is based on UNIDO, "Industrial Development Review: Guatemala", op.cit., Chapter 3.

- The National Finance Corporation (CORFINA), was established in 1972 as an autonomous organization to promote a diversified development of the industrial, mining and tourism sectors. It supported medium- and large-scale firms through long-term financing, equity participation and technical assistance. CORFINA's operations were mostly financed with foreign credits. Considerable cash flow difficulties led to the restructuring of CORFINA as a mixed enterprise in 1984, with a 60/40 per cent equity participation between the public and private sector respectively;

- The Training and Productivity Technical Institute (INTECAP) provides training and educational courses - in particular for middle management - and on-the job training for workers both at INTECAP facilities and/or at factories.

(b) Private sector organizations

The following private sector organizations are also concerned with the industrialization of the country:

- The Guatemalan Chamber of Industry, represents the private sector before the public sector agencies concerned with directing Guatemala's industrialization and other national and international institutions involved with industrial matters;

- The Guatemalan Chamber of Commerce, represents and promotes the interests of its members before the Government and other commercial institutions. It also certifies the origin of merchandise produced locally;

- GUATRADE, is a trading company created by the private sector in 1982 to promote export diversification and the marketing of export products outside CACM markets.

5.4.5 Recent policy and programme changes and their effects on industry and the production of AMI

The production of AMI in Guatemala has been affected by recent policy and programme changes to promote the development of industry in general. In particular, four significant policy changes have had a major effect on manufacturing industry, and therefore the production of AMI, in Guatemala.

First, Guatemala's import control system, which was established in November 1972, has substantially reduced the supply of critical inputs needed by the country's manufacturing industry. This reduction in imported raw materials and other inputs has had adverse effects on manufacturing output and product quality.

Second, the Emmergency Regime on International Transfers was established in 1983. This Emergency Regime allowed the Central Bank to issue public bonds in dollars with repurchasing agreements at compensatory rates. The bank placed two issues of 'stability bonds' for $US 500 million in 1983-1984. Phase II of the Emmergency Regime was passed in November 1984. This introduced a three-tier exchange rate system and variable interest rates along the lines of international markets. New credit lines in foreign currency were also made available to the private sector. The aim of the Emmergency Regime

has been to lighten the financial difficulties facing the private sector of the economy. Unfortunately, the Regime has not been able to make enough foreign exchange available to enable the manufacturing sector to implement a dynamic rejuvenation of industry.[85/]

Third, the 1984 Law on Incentives for Export-Oriented Industries has provided additional fiscal incentives and facilities for re-exporting. This law, which is complementary to incentives provided by the US Caribbean Basin Initiative and other non-reciprocal import agreements, is providing a more favourable environment for the production and export of AMI.

Fourth, the new CACM Common External Tariff Agreement came into effect in October 1985. This agreement has substantially affected both the effective tariff protection and the system of fiscal incentives for industry. It is too early to assess the impact of this new tariff agreement. However, as mentioned earlier in section 5.4.1, the new tariff agreement has favourable provisions explicitly geared towards the AMI industry which should stimulate increased production.

5.5 Future needs of the AMI industry and future action towards the industry by national, regional and international bodies

5.5.1 Future needs of, and national action towards, the AMI industry

Since Guatemala does not have a national agricultural machinery and implements industry the future needs of the industry are considerable. The future needs of the AMI industry are in the following areas:

(a) The definition of specific promotion policies towards the industry;

(b) The formulation of specific industrial projects to act as a catalyst for the development of the industry;

(c) The search for appropriate international technical and financial co-operation.

The need to define specific promotion policies towards the industry is obvious. Basically this evolves the following sequence of steps:[86/]

- Determination of why the development of AMI is important for Guatemala;
- Identification of the existing demand for AMI;
- Identification of appropriate products for agricultural mechanization and rural development;
- Determination of Guatemala's current capabilities for local production;
- Identification of obstacles to production experienced by various types of production units and the formulation of policies to remove these obstacles;

85/ "Industrial Development Review: Guatemala", op.cit., p. 5.

86/ These steps are discussed in detail in Volume I of this study, "Guidelines for the Development of the Agricultural Machinery and Implements Industry in Latin America", UNIDO, Sectoral Studies Branch, 1987.

- Identification and/or the creation of institutional mechanisms for the coordination and promotion of AMI production;
- Creation of an integrated strategy of developing industry in conjunction with the mechanization of agriculture;
- Development of specific national programmes of action to aid the development of the AMI industry.

From the previous discussion and from the views expressed by Guatemalan experts themselves,[87] Guatemala's needs may be best served by the formulation of industrial projects for the production of handtools, especially big hoes, to cut as a catalyst for the development of the AMI industry.[88] Projects for handtools would benefit the majority of rural farmers who still work small plots of land with handtools, and form the basis for the future manufacture of more sophisticated AMI. Other appropriate projects would be those for the production of sowers, cultivators, classifying machines, pickaxes, spades and other types of hoes.

It is also clear that Guatemala should seek appropriate international technical and financial co-operation to instigate and implement these projects. As we shall see in the next section, unfortunately, according to Guatemalan experts, Guatemala's experience with previous external technical assistance has not been particularly fruitful.[89]

5.5.2 Future action towards the industry by national, regional and international bodies

Future action towards the development of the AMI industry in Guatemala essentially takes the form of external technical assistance. Guatemala's efforts to develop a national AMI industry would be greatly enhanced by appropriate technical assistance from regional and international bodies. Unfortunately, as mentioned above, Guatemala's previous experiences with external technical assistance has been anything but rewarding. The reasons for this unfortunate experience with technical assistance (TA) are due to some extent to the country's own inability to utilize TA as it would like, and also to various inadequacies of TA given by external bodies such as the international development agencies and bilateral aid programmes from developed countries.

(a) National limitations

According to Guatemalan experts, Guatemala, like most CA countries, is unable to utilize TA as it would wish. There are many reasons for why this is so:

87/ "Guatemalan National Paper on Agricultural Machinery", op.cit., pp. 7-8.

88/ Ibid., appendix - "La Fabricacion de azadones en herrerías locales".

89/ "Guatemalan National Paper on Agricultural Machinery", op.cit., pp. 7-8.

- The role of international technical co-operation (ITC) or TA has not always been given due importance in national development plans;
- TA or ITC has often not been based on real demands;
- The lack of national institutional mechanisms to co-ordinate TA properly;
- National deficiencies in the formulation, identification and assignment of priorities to projects;
- Limited human resources;
- Restrictions placed on the allocation of resources at the national level; and
- The limited ability of executing units to absorb the knowledge and relevant experiences gained from TA.[90/]

There are a number of undesirable consequences of Guatemala's inability to use TA as it would wish. First, priorities regarding TA are not always reflected in ITC programmes. Second, there is no co-ordination and often incoherence in the use of ITC. Third, projects are frequently badly formulated and executing officers have little ability to control and/or evaluate projects. Fourth, it is common for projects to be re-phased during implementation thus changing end results and objectives, in many cases for the worse.

(b) Inadequacies of TA

Guatemalan experts also maintain that the country has experienced a number of problems with external TA:[91/]

- The resources of ITC have mostly been utilized for general projects instead of for developing solutions for pin-pointed problems;
- The services offered by international experts often have not met with requirements and have not justified their high cost.

As a result of the above problems, Guatemalan experts claim that ITC has not greatly helped to solve Guatemala's problems; neither has the technical assistance of international experts.[92/]

90/ "Guatemalan National Paper on Agricultural Machinery", op.cit., pp. 7-8.

91/ Ibid.

92/ Ibid.

5.6 Conclusions, recommendations and areas for possible technical assistance

5.6.1 Conclusions

Agriculture, especially given Guatemala's low level of industrialization, is the major vehicle for the country's economic development. Priority has been given, and will continue to be given, to the export of agricultural products to help solve the country's balance of payments problems. Unfortunately, until recently, the promotion of large-scale agroexports has led to a reduction in Guatemala's ability to feed itself with its traditional food crops - beans, corn and rice. Indeed, in recent years Guatemala has had to import these crops to be able to feed its people. Large-scale agroexports has led to the marginalization of the peasantry and a growing number of landless peasants. This has caused civil unrest and armed rebellion in the late 1970s.[93/] The balance between the promotion of agroexports and the production of foodstuffs is a problem still unresolved in Guatemala as it is in most of Central America.

There are, however, good prospects for the development of the agricultural sector and therefore for the production of AMI and the growth of AMI industry. There are a number of reasons for this. At present, there is a food crisis in the country. There exists plenty of land that is under-utilized or not utilized at all. Agricultural machinery, tools and implements could increase productivity considerably. There is now official priority given to agricultural development. The Government is promoting the sector by various incentive schemes to aid domestic production and exports. The use of appropriate AMI in agriculture reduces production costs.

On the other hand, the potential for the development of a national AMI is limited by the following obstacles:

- Lack of adequate training in the use and maintenance of AMI;
- Lack of standardization of products;
- Lack of consistant planning of production;
- Lack of a coherent investment policy directed towards the industry;
- Inadequate marketing of projects;
- Inadequate financing of production;
- Inadequate infrastructure, especially roads and communications; and
- The extremely small markets for AMI.

5.6.2 Recommendations

The recommendations of this study for aiding the development of an indigenous AMI in Guatemala relate to external technical assistance and existing obstacles to the production of AMI.

93/ It appears that the armed conflicts have not seriously affected output but tourism receipts have dropped considerably. See John Weeks, op.cit., p. 189.

(a) Technical assistance

We begin with measures that the Government could implement to improve its ability to benefit from TA:

- Elaborate ITC programmes that relect the priorities set forth in National Development Plans that incorporate ITC as an explicit and quantifiable resource;

- Establish institutional mechanism to better co-ordinate ITC and TA;

- Re-inforce the national technical ability to identify, formulate and administer ITC and TA programmes;

- Allocate more financial and institutional support for technical co-operation projects; and

- Appoint and/or train more personnel qualified to facilitate the transfer of technology.

External bodies such as international development agencies and individual developed countries could improve the quality of their ITC and technical assistance programmes as follows:[94/]

- Earmark the bulk of ITC for already identified problems;

- Make the terms of reference for experts clear and precise so as not to allow undesirable improvisation of activities and/or an imappropriate selection of candidates;

- Modify the structure of existing ITC arrangements to give more emphasis to training and supplying appropriate machinery and equipment.

(b) Removal of existing obstacles to the production of AMI

The following steps could be taken to overcome existing obstacles to the production of AMI.

(i) Small market size could be tackled by:

- A carefully defined multi-production approach;[95/]
- Greater efforts to export to neighbouring countries organized into a common market as in the former CACM.

94/ These recommendations for ITC and TA are based on those given in the Guatemalan National Paper on Agricultural Machinery, op.cit.

95/ For a general assessment of the multi-product approach see, "The Multipurpose Approach to Agricultural Machinery Manufacture in Latin America," op.cit. However, it must be stated that in the short term it is unlikely that the multi-production approach can be successfully applied in Guatemala given current economic conditions.

(ii) Inadequate marketing of products could be addressed by action at the national and/or regional levels to:

- Establish co-operative marketing schemes;
- Establish sales and exhibition centres;
- Create an advisory body to help market products;
- Establish centres where products can be displayed;
- To prepare a directory of manufacturers and sellers of AMI.

(iii) Inadequate financing of the production of AMI could be ameliorated by:

- Suitably designed credit schemes.

(iv) Insufficient technical knowledge is a major obstacle which requires a considerable amount of time to overcome.

In this regard, the following steps could be taken:[96/]

- A national and/or regional R&D centre could be established and/or existing centres strengthened;
- Simpler designs of AMI could be produced;
- TA should be sought from international agencies and/or more technologically advanced countries;
- Links should be established and/or existing links strengthened with neighbouring countries to share technical knowledge and the expenses incurred to acquire it and to train people to use and maintain AMI appropriately.

5.6.3 Areas for possible technical assistance in the field of AMI

From the previous discussion it is clear that Guatemala requires technical assistance in the following areas:

(a) The establishment of chemical and metallurgical laboratories to facilitate the production of AMI;

(b) The formulation and implementation of projects for the production of handtools, especially big hoes;

(c) Training in the design, testing, use and maintenance of appropriate AMI.

96/ The above-mentioned remedial actions to overcome obstacles to production are analysed at length in Volume I of this study, "Guidelines for the Development of the Agricultural Machinery and Implements Industry in Latin America," op.cit.

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Guidelines for the development of the agricultural machinery and implements industry in Latin America: Country case studies - Volume II

(please check appropriate box)

		yes	no
(1)	Were the data contained in the study useful?	☐	☐
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(4)	Did you agree with the conclusion?	☐	☐
(5)	Did you find the recommendations sound?	☐	☐
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